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THE IRON TRADE REVIEW

A Weekly Journal Devoted to the Machinery, Metal-Working and Foundry Trades, and Iron and Steel Manufacture.

VOLUME XXXVII — CLEVELAND, OHIO, OCTOBER 27, 1904 — NUMBER 43

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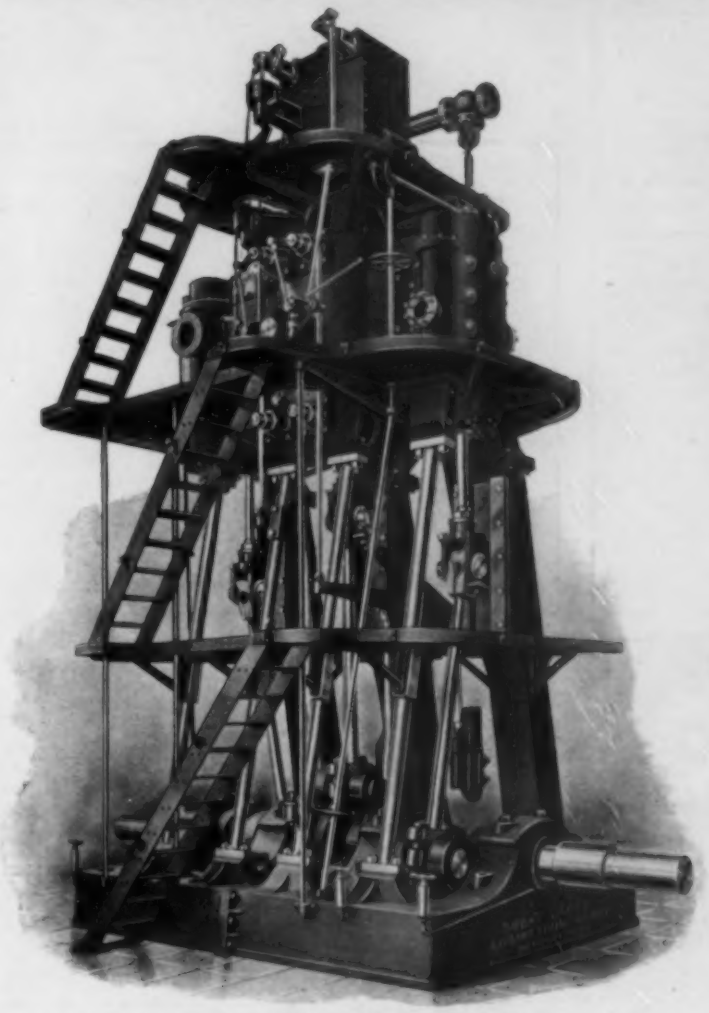

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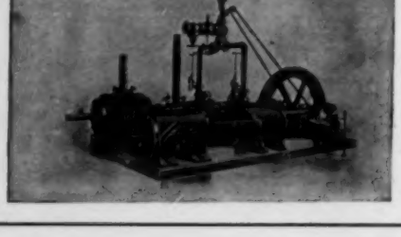

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THE IRON TRADE REVIEW

VOLUME XXXVII CLEVELAND, OHIO, OCTOBER 27, 1904 NUMBER 43

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The present movement of the iron market has reached the stage at which the effect of buying to replenish stocks and as a protection against a possible advance is plainly in evidence. The most noteworthy result has been that pig iron which has suffered most in the depression of the past year is showing steadily increasing strength and there has been a further advance the past week in which foundry iron, basic and Bessemer have all participated. The buying of basic iron in the East which amounted to over 50,000 tons last week for two important plants in the Philadelphia district has brought the price to $13, or $1 above the low-priced transactions of September when the steel corporation was a buyer for its Eastern plants. The persistent report that the steel corporation has bought Bessemer iron from the merchant furnaces of the Mahoning and Shenango Valleys is without foundation and there is no prospect of a combination of circumstances under which the corporation will come into the market. It is more likely to blow out an occasional furnace in the near future in conformity with its policy of making only enough iron to meet current needs of its steel works. Buying of foundry iron has become more general and might be taken to represent a considerable increase in the melt, were it not known that buyers in many cases are regarding it the prudent thing to take some iron in anticipation of their needs and to guard against an advance. There is little significance in the high prices at which Southern grades of iron are being quoted, as the furnaces have only a small tonnage to dispose of until the first of the year, and a sudden termination of the coal strike, which has been the predominating factor in the establishment of present prices, with the resultant increased blast furnace capacity, would soon establish a lower basis. Several sales on the basis of $11.25 Birmingham, for No. 2 are reported, and one large interest is quoting $12 Birmingham, for the small tonnage it has unsold until the first of the year. Three merchant furnace interests at Cleveland and one at Youngstown have agreed to maintain No. 2 foundry on the basis of $13.50, Valley furnace or $14.35, Pittsburg.

The United States Steel Corporation has strengthened its hold on the coke output of the Connellsville region by the purchase of the output of one of the leading independent operators for the next fourteen months, and the sale of the output of another Connellsville operator to an independent furnace interest was consummated this week. Two large steel interests, whose extensive coking operations have proved unsuccessful, have come into the market this week for next year's requirements, and coupled with the inquiries received from nearly every one of the merchant furnace interests, the coke market has been unusually active. The lowest quotation received for the first half of 1905 on furnace coke is $1.65, while most of the producers are asking $1.75.

It is significant that steel billets are selling at full association prices, with rare exceptions, and buyers seek to contract further ahead than mills are ready to sell. In finished material the situation has changed within the past month to such an extent that buyers are not now questioning the stability of association prices fixed at the last revision, but are willing to contract ahead, in a way that has not been seen in many months.

Recent developments relating to new ship building on the lakes indicate something approaching a boom. Business placed and orders that are considered as good as placed, mean full employment of all lake yards for most of the coming year. The tonnage of plates and shapes contracted for on account of this business is understood to be far larger than indicated in earlier estimates.

PITTSBURG.

(Special Telegram.)

PITTSBURG, Pa., Oct. 26.—Four thousand tons forge iron have been sold at $12.80, Pittsburg, deliveries remainder of this year and through first quarter of next year. Bessemer iron is firm at $13.85, Pittsburg, delivery after first of year. A sale of coke to cover requirements of two independent merchant furnaces through 1905 is reported. Large eastern steel companies, including Bethlehem and Pennsylvania Steel companies, have come into market for coke supply for next year.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Oct. 26.

Pig iron prices have again been sharply advanced during the week, and furnace operators are hopeful of securing still better prices in the next fortnight. Whether these prices can be maintained until the first of the year, with numerous idle stacks in the Valleys preparing to blow in, is doubtful, and many fear that a slump from the present basis will give the market another set back. Three idle stacks in the Valleys will resume operations next week, while a fourth at Steubenville, O., resumes in a few days. At least two additional merchant furnaces expect to resume operations about the middle of November and this increased production will surely be felt. The biggest advance of the week has been on foundry iron, inasmuch as only a few furnaces in this and the Valley districts are producing this grade, and at a meeting of Cleveland and Valley producers held last Saturday it was decided to hold No. 2 at $13.50 at the Valley furnace, for prompt and future delivery. Some iron has been sold on this basis, but a number of small buyers who came into the market this week have decided to hold off, believing that better prices could be had later in the year. One of the leading local steel interests has purchased 30,000 tons of Bessemer iron for December and January delivery, at prices ranging from $12.50 to $12.75 at the furnace. The latter quotation is now the mini-

mum at which Bessemer can be had and several operators are asking $13. The Lackawanna Steel Co. has not yet closed for its Bessemer amounting to 40,000 tons, and it is doubtful whether better than $12.75 can possibly be done. An effort has been made to secure this iron from the Bessemer Furnace Association, but inasmuch as none of the furnace operators had closed for their coke requirements for the first half of next year, no price was quoted the steel company at last Saturday's meeting. The leading cast iron pipe interest is still in the market for 8,000 tons of forge iron and it is probable that the order will be placed this week.

The sudden advance in coke prices has alarmed the furnace interests, who had hoped to cover for the first half of 1905 at $1.50. None of the operators in the Connellsville region are quoting below $1.65, and $1.75 is asked by some producers. It has also developed in the past few days that the H. C. Frick Coke Co. has purchased the output of the ovens of the Oliver & Snyder Steel Co. for the remainder of this year and the whole of next year, amounting to 2,500 tons daily. Whether the output of other independent operations has been purchased cannot be learned at this time, but this action indicates a movement in the direction of securing the control of the coke market, and with higher prices for coke than have been prevailing, pig iron prices would have to advance. This move is considered more practical than the purchase of a large tonnage of Bessemer iron, and can be carried into effect with a greater degree of certainty. Furthermore the demand for high grade Connellsville coke is more insistent today than at any time in the past two years. Nearly every large steel producer has built coking plants in that period to insure a steady coke supply, but in the majority of cases the coke has been found to be of an inferior quality and all are now endeavoring to secure coke from the active independent operators in the Connellsville region. The Lackawanna Steel Co. has inquiries out for coke for delivery at Buffalo through 1905, calling for the delivery of 1,800 tons daily. Another steel producer having several furnaces and with a developed coking plant is in the market for high grade coke for next year's delivery, and it is the intention to abandon the coke property. Practically all of the Valley furnace operators are this week endeavoring to cover on their coke requirements for the first half of next year, and the sudden advance in prices indicates that some large interest has quietly been securing the output of the best operators. The Brown Cochran Coke Co. has renewed its contract with W. P. Snyder & Co., whereby the latter secures the entire output of these ovens for 1905. Several large coke operators are again talking of reviving the coke pool which went out of existence several years ago. Each operator sells his own product under its arrangements, but the output is limited.

The recent advance in pipe has resulted in the placing of a large tonnage with the leading interest and another slight advance in the near future is expected by the trade. Orders for wire products are not accepted for delivery beyond December 1, while the tin plate manufacturers are only accepting business through January. The sheet market is very firm at 2.10c, while a few interests are asking as high as 2.15c. The McClintic-Marshall Construction Co. was awarded the contract for the erection of the freight station for the Wabash railroad, requiring 4,000 tons of steel.

Pig Iron.—Not for many months has the pig iron market been as bullish as during the past two weeks, and despite the sharp advances, producers are talking of still higher prices. Practically all of the Northern furnaces in operation are sold up to the first of the year, and on the small tonnage that is available the producers are going to secure the highest possible prices. One large local steel interest purchased 30,000 tons of Bessemer for delivery through December and January at prices ranging from $12.50 to $12.75 at the furnace, and very little Bessemer for delivery this year is now to be had. At a meeting of three Cleveland interests and one Youngstown producer, held at Cleveland on Saturday, it was decided to hold foundry iron for delivery the remainder of this year and into next year at $13.50 at the furnace. This big advance is possible owing to the peculiar conditions now existing in the foundry iron market. Most of the merchant furnaces are operating on Bessemer iron, and only a few stacks are producing foundry, and they are practically sold up to January. In addition the competition of the Southern furnaces is not feared, as they are asking from $11 to $12 Birmingham for No. 2. The Lackawanna Steel Co. has not yet purchased the 40,000 tons of Bessemer for which it inquired, although the inquiry was considered at the meeting of the Bessemer Furnace Association on Saturday. No price has yet been named, and until these furnaces are able to purchase their coke for the first half of next year it is doubtful whether any price can be named. This week the LaBelle Iron Works blows in its No. 2 furnace at Steubenville, O., and next Monday the stack at Lowellville, O., will resume. The Atlantic stack of the Republic Iron & Steel Co. resumes on Nov. 1 and the Cherry Valley stack of the Cherry Valley Iron Co., Leetonia, O., will resume at the same time. We revise quotations as follows:

Bessemer, Valley	$12 75 to 12 85
Bessemer, Pittsburg	13 60 to 13 70
No. 1 Foundry	14 35 to 14 60
No. 2 Foundry	14 10 to 14 35
Gray Forge, Pittsburg	12 50 to 12 85
Chilled basic, Valley	12 50 to 12 75
Chilled basic, Pittsburg	13 35 to 13 60

Steel.—While there has been some buying of steel, the market has been inactive in comparison with pig iron. Agreed quotations are being firmly maintained, however, as follows: Bessemer and open-hearth billets, 4 x 4 in., and slabs, up to and including 0.25 carbon, $19.50, f. o. b. mill, Pittsburg, with actual freight added to point of delivery; 0.26 and including 0.60 carbon, $1 advance; 0.61 to 1.00 carbon, $2 advance. Billets smaller than 4 x 4 in., $2 advance; sheet and tin bars, $2 advance. Bessemer and open-hearth rods are held at $25 to $25.50.

Ferro-Manganese.—There is little demand, and large lots can be had on the basis of $40 per ton, delivered at buyer's mill, at any point east of the Mississippi. Less than carload lots are held at $41 to $41.50, delivered.

Spelter.—The market is firm, and prime western grades are held at 5.35c to 5.37c, delivered in carload lots, Pittsburg.

Muck Bar.—The market is much stronger and higher prices are named owing to the advance in pig iron. We quote high grade bars at $24.50 to $25, Pittsburg.

Skelp.—Demand for skelp continues heavy and prices are slightly higher. Grooved steel is held at 1.25c to 1.30c, and sheared at 1.35c to 1.40c. Grooved iron is held at 1.45c and sheared at 1.50c.

Rails and Track Material.—Demand for light rails has been heavy during the week, and prices have advanced sharply. Twenty-five to 40-pound sections cannot be purchased below $20, while 16-pound sections are held at $22 to $23. We revise quotations as follows: Standard sections, 50 pounds and over, in lots of 500 tons and over, $28; car lots and less than 500 tons, $30; less than car lots, $32; light rails, 16 to 40 pounds, $20 to $23. Spikes, 1.55c to 1.60c.

Plates.—The contract for another lake steamer has been placed during the week, and lake shipbuilders now have contracts for eighteen boats that are to be in readiness at the opening of navigation next year. These ships will require close to 50,000 tons of plates, while the structural material that enters into their construction is no small tonnage. Steel car builders are specifying much more heavily than at any time this year, and the general situation is very strong. Prices are unchanged as follows: Tank plate, ¼ in. thick, 6¼ to 24 in., inclusive, 1.30c. f. o. b. mill, Pittsburg; over 24 in. up to 100 in., 1.40c. Extras are as follows per pound: Flange and boiler steel, 10c; marine, A. B. M. A., and ordinary fire box, 20c; still bottom, 30c; locomotive fire box, 50c;

plates over 100 in. up to 110 in. in width, not less than 5c per 100 lb. extra; plates 110 in. to 115 in. wide, not less than 10c extra; 115 to 120 in., 15c extra; plates 120 in. to 125 in. wide, not less than 25c extra; plates 125 in. to 130 in., not less than 50c extra; plates 130 in. wide, not less than $1 extra; plates 3-16 in. thick, $2 extra; gauges 7 and 8, $3 extra; No. 9, $5 extra. Five cents extra for less than carloads. Terms net cash in 30 days, and for all points of delivery in the United States except the Pacific Coast.

Structural Material.—The McClintic-Marshall Construction Co. has been awarded the contract for the erection of the Wabash freight depot requiring 3 000 tons of material. We make the following quotations: Beams and channels, up to 15 in., 1.40c; over 15 in., 1.50c; angles, 3 x 2 up to 6 x 6, 1.40c; zees, 1.40c; tees, 1.45c; angles, from 3 to 16 in., 1.40c; universal and sheared plates, 6¼ to 24 in. inclusive, 1.30c; over 24 in., 1.40c base.

Bars.—Iron bars are much firmer and it is doubttul if 1.30c Youngstown could be shaded. Hoop prices are being shaded from $1 to $2 per ton, but bands are being firmly maintained at present prices. We revise quotations as follows: Bar iron, 1.30c, Pittsburg; hoops, 1.55c, and bands, 1.30c, both taking bar extras. Bessemer and open-hearth steel bars, 1.30c; plow and cultivator beams, 1.30c, net; channels, angles, zees and tees, under 3 in., 1.40c. The following differentials are maintained on steel: Less than 2,000 lbs. of a size and not less than 1,000 lbs., 10 cents advance; less than 1,000 lbs. of a size, 30 cents advance.

Pipes and Tubes.—The advance in pipe resulted in bringing out heavy specifications and considerable buying. Prices have been abnormally low for some time, and the trade looks for another slight advance in the near future. Discounts to consumers, carload lots, f. o. b. Pittsburg, plus freight to destination according to Tube Rate book, are revised as follows:

MERCHANT PIPE.

	Steel.		Iron.	
	Black.	Galv.	Black.	Galv.
⅛ and ¼ inch	70	54	68	52
⅜ to 6 inches	78	68	76½	66½
⅜ and ½ inch	74	62	72	60
7 to 12 inches	73	58	71½	56

Extra Strong Plain Ends.

⅛ to ⅜ inch	63	51	61	49
½ to 4 inches	70	58	68	56
4½ to 8 inches	66	54	64	52
Double extra strong plain ends, ½ to 8 inches	59	48	57	46

MERCHANT BOILER TUBES, LESS CARLOADS, 22 FEET AND UNDER.

	Steel.	Iron.
1 to 1½ inches	48	43
1¾ to 2½ inches	60	43
2½ inches	62	48
2¾ to 3 inches	68	55
6 to 13 inches	60	43

Sheets.—Demand for sheets continues heavy and present quotations are being firmly maintained. A few producers are asking 2.15c for 28 gauge, and the trade is looking for a slight advance in the near future. We make the following quotations on black sheets in carload lots: No. 8, 1.60c; No. 9, 1.65c; Nos. 12 to 14, 1.70c; Nos. 15-17, 1.75c to 1.80c; Nos. 18-21, 1.85c to 1.90c; Nos. 22-24, 1.95c; Nos. 25-26, 2c; No. 27, 2.05c; No. 28, 2.10c to 2.15c; No. 29, 2.35c to 2.40c; No. 30, 2.50c to 2.55c. Galvanized: Nos. 12-17, 2.20c to 2.25c; Nos. 18-21, 2.35c to 2.40c; Nos. 22-24, 2.50c to 2.55c; Nos. 25-26, 2.65c to 2.70c; No. 27, 2.90c; No. 28, 3.10c; No. 29, 3.45c to 3.50c; No. 30, 3.85c to 3.90c.

Wire and Wire Nails.—No orders are now being booked for delivery beyond Dec. 1, and an advance is generally expected by the trade shortly after election. We make the following quotations: Wire nails, jobbers' carload lots, $1.60; retailers' carloads, $1.65, and less than carloads, $1.75; painted barb wire, $1.75 to jobbers in carloads; retailers' carloads, $1.80, and less than carloads, $1.90, with 30 cents for galvanizing. Annealed smooth fence wire is held at $1.45, with the usual differentials to retailers for carloads and less than carloads. Quotations are all f. o. b. Pittsburg, 60 days, with 2 percent discount for cash in ten days. Iron and steel cut nails are held at $1.65 to $1.70.

Merchant Steel.—Demand has improved somewhat, but the mills are all running light, and until there is a big improvement in machinery construction no big buying movement is looked for. Demand for shafting is only fair. We make the following quotations: Toe calk, 1.90c; carriage spring steel, 1.75c; tire steel, 1.50c to 1.55c; plow steel, 6 in. and under, 1.35c for Bessemer and open-hearth; plow slabs, ¼ in. and heavier, 1.60c. Drawn and cold rolled shafting is held at 52 percent off in carload lots and 47 off in less than carload lots.

Old Material.—Heavy melting stock continues to advance, although very little is changing hands. The mills are not disposed to sell, indicating that they can use it to better advantage themselves, while the dealers are all anxious to secure the highest possible prices. We revise quotations, gross tons, as follows: Heavy melting stock, $12.75 to $13; low phosphorus, $15 to $15.50; rerolling rails, $12 to $12.50; sheet scrap, $10 to $10.50; No. 1 cast, $10.50 to $11; No. 1 wrought, $12 to $12.50, and cast iron borings, $7 to $7.25.

Coke.—The coke situation is now considered the key to future iron trade conditions, and with advanced coke prices, higher prices for iron will be maintained. For delivery the first half of next year producers are asking $1.75 for furnace coke, while a few operators are willing to accept $1.65. Practically all of the independent operators in the Valleys are in the market this week to cover for the first half of next year, and will close for the entire year if they can secure the proper prices. The H. C. Frick Coke Co. is reported to have purchased the entire output of the ovens of the Oliver & Snyder Steel Co. for next year and the remainder of this year. For the next two months $1.65 will be paid, the first quarter of 1905, $1.70 and the remainder of the year $1.75 will be paid. Whether the corporation has secured the output of other ovens cannot be learned, but it is certain that a large tonnage of coke has been taken off the market and prices have advanced accordingly. The Brown, Cochran Coke Co. has again sold its output to W. P. Snyder & Co. for next year. The revival of the old coke pool is again talked of and a meeting may be held shortly. Output is restricted but the product is sold as at present. Foundry coke for immediate and future shipment is held at $2 to $2.15. The Lackawanna Steel Co. continues in the market for about a half million tons of coke for delivery next year. The output of the upper Connellsville region during the week ending Oct. 15 amounted to 194,335 tons and the lower region produced 59,642 tons. This is a slight falling off as compared to the previous week's production.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Oct. 25.

(Special Telegram.)

CHICAGO, Oct. 26.—Southern furnaces have sold a round block of iron in this market on the basis of $12 Birmingham for No. 2 foundry, or $15.65 Chicago, since the following report was written. The local situation has developed into one of great strength, all producers asking $12 for this year's delivery and some $13 for next year. The former quotation, however, is the ruling price and is firmly established, practically all the iron sold this week being on that basis. With few exceptions the Southern interests have opened their books for 1905 business. Northern furnaces have also advanced their prices 50 cents to $1 a ton, as was expected. There has been an exceptionally heavy demand for local irons since Monday and a large tonnage has been booked. The minimum quotation now made is $15 Chicago for No. 2 for delivery in the balance of this year, and $15.50 for shipments in 1905. Bar iron has jumped 50 cents a ton and is now quoted 1.40c Chicago for this year's shipments and 1.45c to 1.50c for next year.

Southern irons have advanced with startling rapidity in the week under review, the activity in this direction being reminiscent of the flush times of two years ago. Since the writing of our last report, when No. 2 Foundry was selling on the basis of $10 Birmingham, iron has advanced by rapid stages to $12 a ton Birmingham. It has found no buyers in this market at this price as yet, the sales reported on the latter basis being to foundrymen located below the Ohio river who have no recourse but to buy from Southern producers. Northern iron has also advanced during the week, the minimum at which No. 2 is now selling being $14 Chicago. Local producers are contemplating further advances in their product before the week is out, and if Southern furnaces maintain their new prices, these will probably go into effect.

In finished iron and steel, the situation is almost as strong as in the crude material. Makers of forging billets have advanced prices $2 a ton; merchant pipe 5 percent, and bar iron 50 cents a ton, all three changes having been made during the week under review. Bar iron is now selling from 1.37½c to 1.40c, with strong leanings towards the latter figure. The demand for each of these products has been very brisk, the changes having stimulated specifications from jobbers and consumers who were backward in laying in stocks. One order for 5,000 tons of axle billets was taken from a local forging plant during the week, while the order for 5,000 tons placed by another local concern mentioned in our last report was increased to 6,000 tons. Inquiry for sheets is large and prices firm. Plates and structurals are enjoying fair demand, the outlook for both products being especially hopeful. The demand for cars, ships and new buildings indicates that the coming year will see a large consumption of the former materials, the inquiry along these lines being especially heavy in the last few weeks. Business in heavy rails is quiet, no improvement being looked for in this trade until after the price for the coming year has been settled. Light sections are healthy and track supplies brisk, mills getting better prices for the former material than for several months past. Specifications on merchant and agricultural steel are heavy, one interest having advanced its prices ¼c per pound on certain special shapes. No cessation is to be noted in the demand for nails and fencing, jobbers generally laying in large stocks for winter and spring use. Coke is quiet and prices firm. Scrap is without change as to prices, though a slightly better demand is felt from consumers.

Pig Iron.—The soaring of Southern pig iron in the week past has much the appearance of a pyrotechnical display. Not since 1902 has the market sustained an advance of $2 a ton in one week, and it is doubtful in view of the conditions prevailing, if the new prices can be maintained. It is evident that in establishing the basis at $12 Birmingham for No. 2 Foundry, Southern producers are uniting to prevent prices from falling again to $9 as has been the case on every previous occasion this year when $10 was reached. There has been little or no profit for furnaces in many months at the prices which have obtained for pig iron; but in a too rapid advance of the pendulum upward there is danger that the return might be precipitate. Not only will it encourage a lot of obselete, isolated stacks, now idle, to start up, and these once in operation, will have to get orders at any price, but an advance of $2 a ton in one week has a chilling effect on foundrymen accustomed for a year or more to buying pig iron at almost their own figures. No sales of foundry iron at $12 have as yet been made in this market, those reported being to foundrymen located in the South. Some transactions are said to have been closed at prices around $11, but there were not enough of these on which to gauge an impression of the market. There is really no established price in this city for Southern iron, producers following the practice of quoting $12 and then announcing they are not in the market. Some interests are willing to book orders for the first quarter of 1905 at this price, but it is needless to add that melters are not accepting these tenders. Virginia irons can be bought on the basis of $11.25 Birmingham for No. 2 for 1904 delivery, and $11.50 for 1905 delivery, which is the first time this year these irons have been able to compete with the Alabama product. The tonnage closed during the week has practically all been taken by Northern furnaces. These have advanced their prices to $14 Chicago for No. 2 for this year's delivery, and are asking 50 to 75 cents a ton more for shipment in 1905. If Southern furnaces continue in their present attitude toward the market, it is a foregone conclusion that before the week is ended, Northern producers will advance their prices 50 cents a ton. The market is very stiff following the brisk demand for Northern irons as a result of the withdrawal of Southern furnaces, and higher prices are the inevitable outcome of the present situation. We have also advanced Lake Superior charcoal to a minimum of $15.50 Chicago, sales having been made in the week past at this figure. Our revised quotations with a spread of 75 cents a ton on Southern iron follow:

Lake Superior Charcoal	$15 50 to 16 00
Northern Coke Foundry No. 1	14 50 to 15 00
Northern Coke Foundry No. 2	14 00 to 14 50
Northern Coke Foundry No. 3	13 50 to 14 00
Northern Scotch Foundry	15 00 to 15 50
Ohio Strong Softeners No. 1	15 30 to 15 80
Ohio Strong Softeners No. 2	14 80 to 15 30
Southern Coke Foundry No. 1	15 40 to 16 15
Southern Coke Foundry No. 2	14 90 to 15 65
Southern Coke Foundry No. 3	14 40 to 15 15
Southern Coke Foundry No. 4	14 15 to 14 90
Southern No. 1 Soft	15 30 to 15 80
Southern No. 2 Soft	14 90 to 15 65
Southern Gray Forge	
Southern Mottled	
Southern Silveries (4% to 6% Silicon)	16 85 to 17 85
Jackson Co. Silveries (6% to 8%)	17 80 to 18 30
Jackson Co. Silveries (8% to 10% Silicon)	18 30 to 18 80
Alabama and Georgia Car Wheel	18 85 to 19 35
Malleable Bessemer	14 00 to 14 50
Basic Iron	14 15 to 15 65

Billets.—A brisk business has been transacted by western mills in forging billets in the week just come to an end. One order for 5,000 tons of axle billets was placed by a Chicago consumer, while the local concern which ten days ago placed an order for 5,000 tons of forging billets has since increased it to 6,000 tons. The new prices on forging billets will go into effect this week, these being an advance of $2 a ton over the former quotations, making the price for 4 x 4 and larger, up to but not including 10 x 10, $24.50, Chicago. Rerolling billets are without change, and we quote Chicago delivery, Bessemer or open-hearth, 4 x 4 and larger, up to .25 carbon, $22.50, up to and including .60 carbon, $1 extra. Billets, 3⅞ in. and smaller, and sheet and tin bars, $24.50. Wire rods, $26 Pittsburg.

Bars.—The leading western producer of bar iron has withdrawn its quotation of 1.35c, and is now asking 50 cents a ton above this figure as its minimum price. An encouraging increase in orders and specifications has been felt in the week under review, all branches of the consuming trade sharing in the improved demand. Specifications for steel bars are very heavy and include some large lots, the western mills running to their full capacity. We quote mill shipments, Chicago delivery, carload lots, as follows: Bar iron, 1.37½c to 1.40c; soft steel bars, 1.46½c; soft steel angles, less than 3 x 3, 1.56½; hoops, 1.71½c, rates, full extras. Local jobbers are quoting iron bars, 1.70c to 1.75c, base, full extras; steel bars and bands, 1.65c to 1.70c, base, half extras; hoops, 2c to 2.10c, rates, full extras.

Sheets.—The demand for both black and galvanized sheets has so far improved that there is little necessity for shading prices to encourage new business. Inquiry has been heavy in the week under review, and a number of mills have instructed their representatives to communicate with the home office before accepting additional orders. Prices are without change, and we quote carload lots, mill shipments, Chicago delivery, as follows: Nos. 9 and 10, 1.71½c to 1.76½c; Nos. 11 and 12, 1.76½c to 1.81½c; Nos. 13 and 14, 1.81½c to

1.86½c; Nos. 15 and 16, 1.91½c to 1.96½c. On box annealed, one pass, cold rolled: Nos. 18 and 20, 2.01½c to 2.06½c; Nos. 22 and 24, 2.06½c to 2.11½c; Nos. 25 and 26, 2.11½c to 2.16½c; No. 27, 2.16½c to 2.21½c; No. 28, 2.26½c to 2.31½c; No. 29, 2.41½c to 2.46½c; No. 30, 2.51½c to 2.56½c. We quote lots from jobbers' stocks as follows: No. 10, 1.90c to 2c; No. 12, 1.95c to 2.05c; No. 14, 2c to 2.10c; No. 16, 2.10c to 2.20c; No. 18, 2.20c to 2.30c; No. 20, 2.25c to 2.35c; No. 22, 2.30c to 2.40c; No. 24, 2.35c to 2.45c; No. 26, 2.40c to 2.50c; No. 27, 2.50c to 2.60c; No. 28, 2.60c to 2.70c; No. 29, 2.70c to 2.80c. Galvanized sheets are fair and prices steady. We quote Pittsburg discounts, f. o. b. mill, 80 and 5 to 80 and 10. For shipment from stock, we quote heavy gauges and wide widths, 75 to 5 to 75 and 10 percent; for light gauges, 75, 10 and 7½ percent to 80 percent.

Structural Steel.—No contracts of any moment have been let in the period under review, though the demand for plain material shows a marked improvement over the sales of the week preceding. A great amount of structural work is pending, the bulk of which is expected to be placed before the building season for next year opens. Independent mills are said to be shading prices on the lighter structural shapes, and with this reservation, we quote the association schedule on carload lots, Chicago delivery, mill shipments: Beams and channels, 3 to 15 in. inclusive, 1.56½c; angles, 3 to 6 in., ¼-in. and heavier, 1.56½c; angles, larger than 6 in. on one or both legs, 1.66½c; beams, larger than 15 in., 1.66½c; zees, 3-in. and over, 1.56½c; tees, 3 in. and over, 1.61½c, with the usual extras for cutting to exact lengths, punching, coping, bending or other shop work. Store price on structural materials are 1.80c to 1.90c for angles, beams, channels, base sizes, with 1.90c to 2c for 18, 20 and 24-in. beams; tees and zees, 1.85c to 1.95c. These prices are for either random lengths or cut to lengths.

Plates.—This product is probably the quietest on the list of finished material, inquiry being of small proportions for some unaccountable reason. The outlook, however, is bright, and with the improved demand for new rolling stock, freight boats, etc., mills are looking for a betterment of conditions in the near future. We quote official prices, carload lots Chicago delivery, as follows: Tank steel, ¼-in. and heavier, 24-in. wide and under, rectangular plates only, 1.46½c base; over 24-in. to 100-in. wide, 1.56½c base; flange steel, 1.66½c base; marine steel, 1.76½c base, all full extras. Plates, 3-16-in. thick, $2 extra; gauges 7 to 8, $3 extra; No. 9, $5 extra. Less than carload lots, 5c extra. Prices from store are as follows: Tank steel, ¼-in. and heavier, 1.80c to 1.90c; 3-16, 1.90c to 2c; No. 8, 1.90c to 2c; flange steel, 2.05c to 2.15c.

Rails and Track Supplies.—Light sections and track supplies continue in good demand, mills reporting that in a number of transactions closed in the past week better prices were obtained than for several months past. Standard rails are quiet, and no demand is looked for until after the price for the coming year has been agreed upon. We quote as follows: Heavy sections 500 tons and over, $28; less than 500 tons to carload lots, $30; less than carload lots, $32; second quality rails, $27; light rails, $22 to $24; track supplies, f. o. b. Joliet mill, angle bars, 1.30c; spikes, first quality, 1.60c; track bolts, 3¼ x ¾, with square nuts, 2.20c to 2.30c per 100 lb.; with hexagon nuts, 2.35c to 2.45c.

Merchant Steel.—Some of the larger concerns have advanced prices on certain special steels ¼c per pound. The demand for the shapes listed below is so brisk that manufacturers are turning down undesirable business and choosing only the most profitable orders. Specifications against old contracts are of ample proportions, the entire output of producers going into immediate consumption. We quote carload lots, mill shipments, Chicago delivery, as follows: Spring steel, 1.85c; sleigh shoe, flat sizes, 1.51½c; concave and convex, 1.60½c to 1.71½c; cutter shoe, 2.25c; smooth finished machinery steel, 1.71½c; smooth finished tire, 1.66½c; plow steel, 2.20c and upwards, according to quality; toe calk steel, 2.01½c; crucible tool steel, 6½c to 8c; special grades of tool steel, 13c and up; cold rolled shafting 52 percent from list in carload lots, and 47 percent discount in less than carload lots.

Merchant Pipe.—The leading interest has advanced its prices on both black and galvanized pipe 5 percent, the change being put into effect on the 19th. Demand has been very heavy since that date, jobbers in all parts of the west laying in good sized stocks. We have revised our quotations, and quote carload lots, mill shipments, random lengths, f. o. b. Chicago, as follows:

MERCHANT PIPE.

	Steel Pipe.		Guaranteed Wrought Iron Pipe.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ and ¼ inches	70.35	54.35	68.35	52.35
⅜ and ½ inches	74.35	72.35	72.35	70.35
¾ to 6 inches	78.35	68.35	76.85	66.85
7 to 12 inches	73.35	57.35	71.85	56.85

Boiler Tubes.—There is little activity to the local market, orders and specifications coming in slowly. Prices are weak, but apparently are being maintained. We quote mill shipments, Chicago delivery, as follows:

BOILER TUBES.

	L. W. Steel. Percent.	C. C. Iron. Percent.	Seamless Steel. Percent.
1 to 1½ inch	46.35	41.35	52.35
1¾ to 2¼ inch	58.35	41.35	40.35
2½ inch	60.35	46.35	43.35
2¾ inch to 5 inch	66.35	58.35	Up to 4 inches. 50.85
6 to 13 inch	58.35	41.35	

The following are the agreed discounts from store:

	Steel.	Iron.	Seamless Steel.
1 to 1½ inches, inclusive	42½	37½	40
1¾ to 2¼ inches, inclusive	52½	35	37½
2½ inches, inclusive	55	37½	40
2¾ to 5 inches, inclusive	62½	47½	47½
6 inches and larger	52½	35	..

Cast Iron Pipe.—Producers report a quiet week, ascribing the apathy to the unseasonable time of the year. Prices are firm but without change. We quote carload lots, Chicago delivery, as follows: Four-in. water pipe, $25.50; 6-in. to 12-in. $24.50; larger sizes, $24; gas pipe, $1 a ton higher.

Wire Products.—Business continues of the same active proportions as formerly, which is about all that can be said of these materials. Prices are firm and without change. We quote carload lots to jobbers, Chicago delivery, mill shipments, as follows: Wire nails, 1.75c; painted barb wire, 1.90c; galvanized barb wire, 2.20c; smooth annealed wire, 1.60c; smooth galvanized wire, 1.90c; polished staples, 1.85c; galvanized staples, 2.15c. Less than carload lots to jobbers are 5 cents higher than above prices. The retail trade is quoted 5 cents extra over the foregoing on carload lots, and 10c extra on less than carload lots. Bale ties are unchanged at 82½c and 5 percent discount f. o. b. Waukegan, Ill., on straight carload lots. Poultry netting, 85 and 5 percent discount from list f. o. b. Joliet and DeKalb, with actual freight allowed not exceeding 50 cents per 100 pounds.

Foundry Coke.—Interest in coke has sagged somewhat as a result of the developments in pig iron, the two products acting in sympathy with each other. Prices, however, remain firm. We quote standard 72-hour Connellsville grades, $2 at the ovens, or $4.65 Chicago. Wise County coke, $4.25 Chicago, and Pocahontas and New River, $4.40.

Old Material.—Two important railroad lists are out this week, one from the C. B. & Q. for 4,500 tons and another from the C. & E. I. for 800 to 1,000 tons. The local market is without material change either in the way of prices or demand. Most all the large consumers of scrap have several months' requirements on hand, yet despite this fact dealers continue to maintain their prices at the high levels before mentioned. We quote selling prices, gross tons, as follows:

Old steel rails (4 feet and over)	$11 50 to 12 00
Old steel rails (less than 4 feet)	10 50 to 11 00
Relaying rails, subject to inspection	21 50 to 22 50
Relaying rails for sidetracks	18 00 to 20 00
Old wheels	12 00 to 12 50
Heavy melting steel	11 00 to 11 50
Mixed country steel	7 00 to 7 50
Low phosphorus scrap (.04 and under)	11 00 to 12 00

The following quotations are for net tons:

No. 1 R. R. wrought	12 50 to 13 00
No. 2 R. R. wrought	11 50 to 12 00
Shafting	12 50 to 13 00
Dealers' Forge, No. 1	10 00 to 10 50
Wrought pipe and flues	9 00 to 9 50
No. 1 cast, 150 lb. and less	10 50 to 11 00
No. 1 mill	6 00 to 6 50
Country sheet	5 00 to 5 50
No. 1 boilers, cut	9 00 to 9 50
Boiler punchings	9 50 to 10 00
Iron car axles	17 00 to 17 50
Steel car axles	13 50 to 14 00
Iron axle turnings	7 50 to 8 00
Steel axle turnings	7 50 to 8 00
Cast borings	5 00 to 5 50
Mixed borings, etc	5 00 to 5 50
Wrought turnings	7 25 to 7 75
Machine shop turnings	7 25 to 7 75
Railroad malleable	9 50 to 10 00
Agricultural malleable	9 00 to 9 50
Stove plate and light cast scrap	9 50 to 10 00
Old iron splice bars	13 00 to 13 50

DeCamp Bros. & Yule Iron, Coal and Coke Co., St. Louis, Mo. has opened an office in Chicago at suite 1103, Fisher building, which has been placed in charge of A. B. Stevenson, for many years identified with the pig iron and coke business in St. Louis and Chicago.

CLEVELAND

OFFICE OF *The Iron Trade Review*,
1064 ROSE BUILDING, Oct. 26.

The improvement in the demand for foundry pig iron and the accompanying advance in price have been the prominent features of the week and the market for finished materials is also stronger. The question which all are asking is, "Will the decided change for the better continue?" The more conservative dealers deplore the tendency in some quarters to give the present increased demand the appearance of a boom.

Iron Ore.—The advance in prices of pig iron has made the ore market firmer, but there is little change in price. Ore prices are about as follows: Old range non-Bessemer, $2.65; Mesabi non-Bessemer, $2.50; old range Bessemer, $3.25 to $3.35; Mesabi Bessemer, $2.75 to $3. There is increased activity on the ranges and shippers are having much difficulty in getting cars to carry the ore to upper lake ports. Furnaces which have not placed orders to meet their requirements find a scarcity of ore and those which bought recently are congratulating themselves on not having longer delayed. Freights are firm at rates of last week and there is a brisk demand for tonnage.

Pig Iron.—The market has advanced rapidly owing to increased demand. Local furnaces have raised their quotations $1, and are now selling No. 2 at $13.50 at the stacks for Cleveland buyers. In the Valley, the price is $13 to $13.50 for No. 2 foundry, while basic and malleable sell at $13. A considerable number of furnaces have no iron for the remainder of this year, while others are so nearly sold up that they are making little effort to take orders. There is much inquiry, but little buying, for the first quarter of 1905. Prices of Southern have advanced nominally from $10 to $12, but sales at $11.50 and $12 are made for Southern consumers only and little Southern has been sold in this territory at any price. We quote as follows for Cleveland delivery:

Bessemer	$13 60 to 13 70
No. 1 Strong Foundry	14 00 to 14 60
No. 2 Foundry	13 50 to 14 35
No. 3 Foundry	12 50 to 13 00
No. 2 Southern	14 85 to 15 00
Gray Forge	12 50 to 13 00
Gray Forge, Southern	13 00 to 13 50
Lake Superior charcoal	15 00 to 15 25

Finished Material.—The improvement is not so marked as in pig iron, the business is better in nearly all lines. Billets are firm at official quotations and in some cases sales have been made at higher figures. Steel bars at 1.39½c Cleveland for Bessemer and 1.44½c for open-hearth are firm and in good demand and specifications are liberal. The usual price of bar iron is 1.35c at the mill. The mills are having considerable difficulty in getting scrap at prices which will enable them to make iron at 1.35c and realize a profit, but it will be no easy matter to advance the price of bar iron unless the quotations in steel bars advance. The sheet business is ragged, being more unsatisfactory in Cleveland than at almost any other selling point. The announced prices are being shaded. The prices of the principal producers through jobbers are as follows, Cleveland delivery, the freight from Pittsburg being 9½ cents: Mill sales of black sheets in carload lots, No. 10, 1.64½c; No. 11-12, 1.69½c; No. 14, 1.79½c; No. 16, 1.89½c; No. 27, 2.14½c; No. 28, 2.24½c. Galvanized, mill sales, No. 14, 2.24½c; No. 16, 2.34½c; No. 18-20, 2.49½c; No. 22-24, 2.64½c; No. 25-26, 2.84½c; No. 27, 3.04½c; No. 28, 3.24½c. Out of stock black sheets: ¼-in. 1.90c; 3-16-in., 2c. Blue annealed: No. 10, 2.05c; No. 12, 2.10c; No. 14, 2.15c; No. 16, 2.25c. One pass cold rolled: No. 18-20, 2.35c; No. 22-24, 2.40c; No. 26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 30, 3c. Galvanized out of stock: No. 16, 2.60c; No. 18-20, 2.70c; No. 22-24, 2.85c; No. 26, 3.05c; No. 27, 3.25c; No. 28, 3.45c; No. 30, 4.25c.

Old Material.—Prices are still tending upward, but transactions are limited, as buyers are unwilling to pay the higher prices. We quote gross tons as follows:

Old iron rails	$18 00 to 19 00
Old steel rails (over 6 feet)	12 50 to 13 50
Old steel rails (under 6 feet)	12 50 to 12 75
Old car wheels	11 50 to 12 00
Steel boiler plate	9 00 to 10 00
Malleable iron (railroad)	12 00 to 12 50
Malleable iron (agricultural)	8 50 to 9 50
Heavy steel	12 00 to 13 00

We quote as follows, net tons:

No. 1 R. R. wrought	$12 00 to 12 50
No. 1 busheling	11 00 to 11 50
No. 1 machine cast	11 50 to 12 00
Iron axles	16 50 to 17 00
Axle turnings	9 00 to 10 00
Wrought turnings (free from cast)	7 50 to 8 00
Grate bars	7 50 to 8 50
Pipes and flues	9 00 to 9 50
Tank iron	8 00 to 8 50
Hoop and band iron	5 00 to 5 50
Sheet iron	4 00 to 5 00
Wrought drillings	6 50 to 7 00
Stove plate	8 00 to 9 00
Steel axles	14 00 to 15 00
Cast borings	5 25 to 5 75

CINCINNATI.

Oct. 25.

Coke.—The coke market is firm and it is difficult to obtain satisfactory quotations for next year's delivery. For current business, foundry coke is quoted at $1.90 to $2.15 f. o. b. Connellsville.

Pig Iron.—The market has made a further advance the past week and again it is difficult to locate prices with accuracy. There has been a decided increase in the buying and as the week progressed quotations were advanced. Today we regard $11 Birmingham for No. 2 as a basis as minimum and sales have been made as high as $12 Birmingham in a few instances and on small lots. There is plenty of inquiry, among which are, however, an Ohio manufacturer for 3,200 tons for delivery to July 1, a car manufacturer for 2,500 tons for the first quarter of next year and the leading cast iron pipe interests. The southern furnace interests that have iron on hand are still refusing to sell or quote, and have simply withdrawn from the market. A few furnaces are taking on tonnage for next year, but as each advance in the price is found to bring business the quotation is advanced and the market is tested for the higher figure. Ohio irons have responded to the advance in the southern product and for No. 2 foundry, $13 furnace is the quotation with $13.50 asked by several northern makers. It is said that $11 is freely bid for iron in the warrant market with few if any sellers at price. Consumption is reported as increasing. The majority of buyers want

prices for deliveries extending into next year. Virginia irons are advancing in line with the Birmingham and other Southern productions.

There is a feeling developing in the trade that the rapid advance in prices has taken place too far ahead of actual improvement in consumption and that values may be pushed to a point that can not be maintained when the production of pig iron increases as it will in all probability under the stimulus of such a rising market. The advance has been so sudden and so rapid that the trade is a little bewildered. Current quotations f. o. b. Cincinnati are as follows:

Southern Foundry No. 1	$14 25 to 14 75
Southern Foundry No. 2	13 75 to 14 25
Southern Foundry No. 3	13 25 to 13 75
Southern Foundry No. 4	13 00 to 13 50
Southern Foundry No. 1 soft	14 25 to 14 75
Southern Foundry No. 2 soft	13 75 to 14 25
Gray Forge	12 75 to 13 00
Northern Foundry No. 1	14 65 to 14 90
Northern Foundry No. 2	14 15 to 14 40
Southern car wheel iron	17 25 to 17 75

Finished Material.—The demand holds up well and there is a good undertone to the market. Bar iron is showing some further strength and the inside quotation is not freely quoted. Bar iron is quoted at 1.35c to 1.40c; steel bars at 1.43c, half extras, with dealers quoting 1.60c to 1.75c for iron and steel out of store. Galvanized sheets are at 80 and 10 percent off. We quote black sheets, No. 27, at 2.25c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 2.60c; No. 27, 2.50c; No. 16, 2.10c; No. 14, 2c; No. 12, 1.95c; No. 10, 1.90c. Tank plates are dull and sell out of store at 1.85c for ¼-in. and 1.95c for 3-16-in., No. 8 and No. 10. Beams and channels are quoted at 1.85c from stock and angles at 1.85c to 1.90c for base sizes.

In merchant pipe the quotations have been advanced and there is more demand reported. The independent mills are still underselling the schedule but have marked up their prices in line with the advance of the leading interest. The following are the quotations for car lots, f. o. b. Cincinnati:

MERCHANT PIPE.
(Basing Discounts.)

	Steel Pipe. Black. Percent.	Steel Pipe. Galv. Percent.	Guaranteed Wrought Iron Pipe. Black. Percent.	Guaranteed Wrought Iron Pipe. Galv. Percent.
⅛, ¼ inch	68.7	52.7	66.7	50.7
⅜, ½ inch	72.7	60.7	70.7	58.7
¾ to 6 inch, inclusive	76.7	66.7	75.2	65.2
7 to 12 inch, inclusive	71.7	56.7	70.2	55.7

BOILER TUBES.

	Steel. Percent.	Iron. Percent.
to 1½ inch	41.2	37.7
1¾ to 2¼ inch	54.2	36.7
2½ inch	56.7	41.7
2¾ to 3 inch	63.2	49.2
6 to 13 inch	54.2	36.7

Old Material.—The market is more active and prices are advancing. Quotations are higher on nearly all descriptions. We quote:

Old No. 1 railroad wrought, net tons	$12 00 to 12 50
Cast machine and foundry, net tons	10 50 to 11 00
Old iron rails, gross tons	14 50 to 15 00
Old steel rails, gross tons	10 50 to 11 00
Old short lengths, gross tons	11 00 to 11 50
Old iron axles, net tons	14 50 to 15 00
Stove plate, net tons	8 00 to 8 50
Wrought turnings, net tons	7 50 to 8 00
Cast borings, net tons	5 50 to 6 00

NEW YORK.

NEW YORK OFFICE OF *The Iron Trade Review*,
ROOM 1315, NO. 150 NASSAU ST., Oct. 25.

Pig Iron.—The market during the past week witnessed a still further strengthening in prices, in which Southern irons were the feature. At the present writing an accurate quotation on Southern No. 2 foundry is impossible, it being entirely a question of quantity and delivery. The majority of Southern furnaces are out of the market for this year's delivery. The few furnaces that are taking orders for this delivery are asking and receiving $11.50 to $12 Birmingham for No. 2 foundry. Practically all furnaces, especially in the South, are reluctant to quote for deliveries for next year. Not in some time has there been so much business hanging fire. The lowest estimate of the tonnage represented is 50,000. Inquiries are plentiful, especially for delivery next year. In the latter category is one lot of 11,000 tons for delivery the first six months. We note inquiries also for one lot of 6,000 tons, two lots of 3,000 tons each, and several lots for 1,000 tons each, delivery covering the first quarter of next year. Inquiries for smaller lots, forming a considerable tonnage, have been received also. Northern irons are at least 50 cents per ton higher than a week ago, with large sales reported for all deliveries. As for the market in general, it can be said that its trend is affording great satisfaction to sellers, for instead of seeking buyers as they were compelled to do a short time ago, buyers are now forced to seek them, and they interpret the many inquiries they are receiving as positive proof that even buyers are convinced that the new year will see a higher range of prices prevailing. New York quotations at tidewater follow: Northern No. 1 foundry, $15.25 to $15.50; No. 2 foundry, $14.50 to $14.75; No. 2 plain, $14.00 to $14.25; No. 1 Southern, $15.25 to $16; No. 2 foundry, $15.25 to $15.75; No. 3 foundry, $14.75 to $15.25; No. 4 foundry, $14.50 to $14.75.

Finished Iron and Steel.—There were no developments of importance in the structural material situation during the past week. Current orders are confined to small lots, making only a fair business in the aggregate. Railroads are heard from for only small quantities. Bars are slightly improved. There is a better demand for plates, but trade is of the odds and ends variety. Sheets are without interest. New York prices at tidewater follow: Angles, 3 to 6 in. x ¼ in. and heavier, 1.54½c; beams, 3 to 15 in., 1.54½c; channels, 3 to 15 in., 1.54½c; beams, 18, 20 and 24 in., 1.64½c; tees, 3 x ¼ in. and heavier, 1.59¼; plates, carloads, tank, 1.54½c; flange, 1.64½c; marine and ordinary fire box, 1.74½c; refined iron and soft steel bars, 1.44½c; sheets, in carload lots, New York, No. 28, black, 2.30c to 2.35c; galvanized, 3.30c to 3.35c.

Old Material.—Prices show no variation from those which prevailed a week ago, but are firmer with an upward tendency. Holders continue to ask prices that are prohibitive, so far as effecting sales is concerned. The demand is good. Railroads are not as anxious to sell their old rails as they were a few weeks ago. We quote f. o. b. cars:

Old iron rails	$14 00 to 14 50
Old steel rails, long lengths	11 50 to 12 00
Old steel rails, short pieces	11 00 to 11 50
Relaying rails	19 00 to 20 00
Old car wheels	11 50 to 12 50
Old iron car axles	17 00 to 18 00
Old steel car axles	14 00 to 14 50
Heavy melting steel scrap	11 50 to 12 00
No. 1 railroad wrought scrap	11 50 to 12 00
Iron track scrap	10 75 to 11 25
Wrought pipe	8 50 to 8 75
Ordinary light iron	6 00 to 6 25
Cast borings	5 00 to 5 25
Wrought turnings	6 75 to 7 25
No. 1 machinery cast	10 50 to 10 75
Stove plate	8 25 to 9 75

BIRMINGHAM.

BIRMINGHAM, Ala., Oct. 24.—The Alabama pig iron market conditions are still very steady and furnacemen are not anxious to take on business any more for delivery this year. Quotations are firm and for immediate delivery the product is bringing a higher price than has prevailed for many months. In the Birmingham territory, that is within 150 to 200 miles from the furnace, prices have advanced to $11 and $11.50 per ton, No. 2 foundry iron. Some small lots have already been sold as high as $12. The Sloss-Sheffield Steel & Iron Co. does not deny that it is holding iron for an advance in quotations and expects $12 per ton for No. 2 within a short while. Three of the smaller companies in this district are said to be supplied with business to keep them engaged for the balance of the year. So far there has not been much iron sold yet in this district for delivery after Jan. 1, 1905.

The production is holding up nicely. An error was made

recently in stating that the Republic company had to shut down one furnace at Thomas on account of the coal supplies. This company has two furnaces in blast at Thomas. Its big rolling mills in Birmingham are requiring no small amount of iron. During the strike of the union coal miners this company is finding a steady supply of fuel with the Sayre Mining Co., whose mines are located in the western part of Jefferson county and whose product is being washed in the Republic company's washer at Sayreton.

Some small lots of iron were sold during the past week in the Birmingham district, $12 per ton being the highest price obtained for No. 2 foundry. The Chattanooga Pipe & Foundry Co., needing an immediate delivery of 500 tons, is said to have paid $11 per ton for the product. A lot of 300 tons went to the Sheffield, Ala., district at $10.75 per ton, No. 2 foundry. Other small lots were sold during the past week at prices ranging from $11 to $11.50 per ton.

The activity in steel and cast iron pipe circles in this district is causing attention to be drawn to them. The steel industry is very busy. The two steel plants in the state are producing no small amount of product, the Tennessee Coal, Iron & Railroad Co., is enjoying a good demand for steel rails, while the Alabama Steel & Wire Co. is still loading steel rods, wire and nails right from machines. This company has orders on hand which will last it for some time to come.

The strike of the United Mine Workers of America, Alabama district No. 20, is still on, but operators state that "the strike has been forgotten." Quite a number of non-union men are still being brought into the district to take the places of the striking miners. The coal production in the state is heavy. The State Mine Inspector expresses the belief that the aggregate coal output for the year 1904 will reach 12,400,000 tons against 13,700,753 tons during 1903.

The cast iron pipe works in the Birmingham district continue to melt great quantities of iron and their shipments of pipe are heavy. A number of experienced pipemakers from the North are coming this way in search of work now and many are getting employment. Good prices prevail for pipe. Future prospects are bright.

The following pig iron quotations are given: No. 1 foundry, $11.50 to $12; No. 2 foundry, $11 to $11.50; No. 3 foundry, $10.50; No. 4 foundry, $10 to $10.50; gray forge, $9.50 to $10; No. 1, soft, $11 to $11.50; No. 2, soft, $11 to $11.50.

The two rolling mills in this district in operation are shipping their product right along with reports in that there is a good demand for finished iron and steel at fair prices. The big Birmingham mills of the Republic Iron & Steel Co., which started up this month after an idleness of eleven months, are doing better than was expected of them. The men laboring in the plant are in shape for a long spell of hard work.

The Republic Iron & Steel Co. gives notice today that work at its Gate City rolling mills, which have been idle since July 2, will resume on Monday next. About 300 men will be given employment at this plant. There is an improved demand for finished iron and steel, hence the resumption of work at the mills. The Republic company two weeks ago started up its Birmingham rolling mills after an idleness of eleven months. The Gate City plant is in good shape, some minor improvements having been made while there was no work being done there. This will complete the resumption of work at all rolling mills in the state except one at Gadsden and one at Anniston. Superintendent R. H. Pritchard, of the Gate City mills, asserts that the prospects are bright for a steady operation of the plant for some time. The water supply for the mill is being looked after, there having been a long drouth in this section until creeks and other sources have been drawn from heavily.

The Shenango tin mill of the American Sheet & Tin Plate Co., New Castle, Pa., was shut down this week. The mill will probably resume next Monday. The Greer tin mill at this place continues idle.

The Metal Market.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, No. 150 NASSAU ST., Oct. 25.

Pig Tin.—After being strong all the week, the market today sold off a little, with the feeling, however, as to the near future quite hopeful. General business is reported to be improving. The London market for the week was active, with prices, especially for spot, showing decided weakness. Closing prices today follow: Spot and October, 28½c to 28¾c; November, 28.40c to 28.70c. London's closings today follow: Spot £130 12s 6d; futures, £129 15s. Arrivals at Atlantic ports for the month to date aggregate 2,670 tons, with 985 tons afloat.

Copper.—Europe a heavy buyer, and the domestic trade reported to be improving, form the main reasons for an advance of ¼c in all grades over previous quotations. The London market has been active during the week, with prices firmer. Closing prices today follow: Lake, 13⅜c to 13½c; electrolytic, 13⅛c to 13⅜c; casting, 13.00c to 13⅛c. London's closings today follow: Spot, £60 11s 3d; futures, £60 17s 6d. Exports for the month to date amount to 16,160 tons.

Lead.—Spot is both scarce and higher at 4.37½ to 4.42½c. St. Louis and London are higher at 4.20c and £12 7s 6d, respectively.

Spelter.—Is firmer and active at 5.30 to 5.35c. St. Louis advanced to 5.20c. London cables £23 7s 6d.

Antimony.—All grades are considerably stronger. Cookson's is 7.25c to 7.50c; Hallet's, 7.00c to 7.25c; other grades, 6.25c to 6.50c.

Quicksilver.—We quote $40 per flask of 76½ lb. in lots of 100 flasks. London is £7 15s.

Nickel.—Sales are made at 40c to 47c for large lots down to a ton, and at 50c to 60c for smaller quantities.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Oct. 25.

Metal trading in the past week has been quiet. Prices, however, are firm and the outlook is bright. Sheet zinc and pig tin are both higher. We quote as follows: Lake copper in carloads, 13¼c, and for smaller lots, 13½c; casting, 13c for carloads, and 13⅜c for lesser quantities. Pig tin, carloads, 29¼c, and 29⅝c to 30c for less than carload lots. Spelter is stronger and is now quoted 5¼c to 5½c, according to quantity; sheet zinc, 6c for carload lots of 600-lb. casks, and 6.25c to 6.30c for less than carload iots. Pig lead, 4.20c for 50-ton lots; 4.25c for carload lots, and 4.35c for smaller lots.

Old metals are firm and we have advanced our prices of last week ¼c all through the list. Demand has been excellent. We quote copper wire and heavy, 11½c; copper bottoms, 10¼c; copper clips, 11c; red brass, 10¼c; red brass borings, 8c; yellow brass, heavy, 7½c; yellow brass borings, 6½c; light brass, 6c; tea lead, 4c; zinc, 3.65c.

The Citizens' Industrial Association of America will hold its second annual convention in New York City Nov. 29 and 30. The indications are that there will be fully 500 delegates in attendance. The headquarters will be at the New Astor hotel. All organizations that sympathize with the purposes of the association are invited and requested to send delegates. The usual reduction in railroad rates will be furnished on the certificate plan.

The Stoddard Metal Co., of Chicago, has been organized by E. B. Stoddard, A. E. Woodhull and others to manufacture babbitt metals, electrotype metals and all the white alloys. The company's offices are located at 1164 Monadnock block, and its plant, which is entirely new, at 150 South Homan avenue, Chicago.

The Gisholt Machine Co.'s Exhibit at the World's Fair.

The exhibit of the Gisholt Machine Co., of Madison, Wis., at the St. Louis Fair, contains nine machines. Three of them are standard turret lathes in the 21, 24 and 28-in. ma-

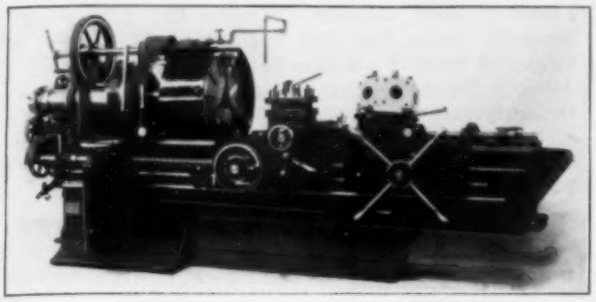


FIG. 1—THE "BIG BORE" TURRET LATHE.

chines, one turret lathe swinging 24 in. and having a 5-in. hole in the spindle, three vertical boring mills in the 42, 52 and 64-in. sizes, one 60-in. horizontal boring and drilling machine and a universal tool grinder. The best known of these machines are the turret lathes, this company having been closely identified with the manufacture of heavy turret lathes for the past fifteen years.

It is only a comparatively few years ago that the possibility of a turret machine for economically finishing medium and large pieces was recognized by but few mechanics. The machines as then built were inadequate to withstand the finishing strains and the methods of finishing medium and large pieces on turret machines were then only in their infancy. The wide shaving cuts and multiple tools employed on Gisholt lathes have necessitated building the machines in the

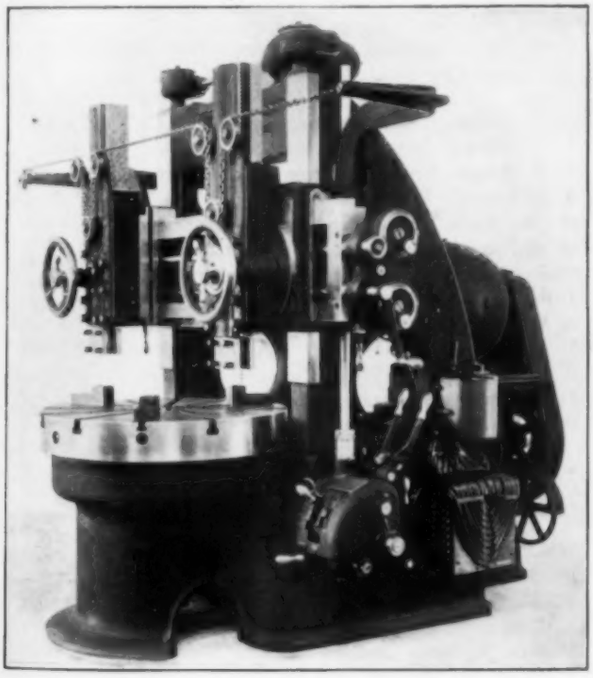


FIG. 2—THE GISHOLT BORING MILL.

strongest possible manner. To obtain the best results in all cases where wide shaving cuts or several tools cutting at once are employed, a radical departure from the ordinary type was found necessary. The Gisholt lathe of today is the result. These machines are now made in six sizes, 13, 21, 24, 28, 34 and 41-in. and have been adapted to the finishing of many thousand different parts.

The "Big Bore" turret lathe, Fig. 1, is a machine capable of a large range of work. It has a 5-in. hole in the spindle and is especially built for the finishing of large work from the bar. In addition to bar work it is of course adaptable to chucked work. The vertical boring mills, Fig. 2, present a number of new and novel devices, and were illustrated in *The Iron Trade Review* of July 7, 1904. The table on sizes below the 60-in. may be a universal and combination chuck fitted with three movable jaws or a plain table may be provided having radial "T" slots and independent jaws. On machines above the 52-in. the latter form of table is used. All these mills, except the 42-in., are fitted with a quick traversing device operated by power for the rapid handling of the heads. On account of the small distance to be traversed and the ease of handling, owing to the friction headstock, this device is not considered necessary on the 42-in. machine.

The horizontal mill shown in Fig. 3 is one of the very latest tools produced by the company. The headstock is of the friction back geared type with two sets of back gearing. The boring bar is of hammered crucible steel accurately ground and with taper socket for the insertion of supplementary boring bars. The feed mechanism is of the same type used on the Gisholt lathes, operated by a coarse hitch screw. The feed is positive and no extra attachment is required for screw cutting. Operating levers are located on both sides

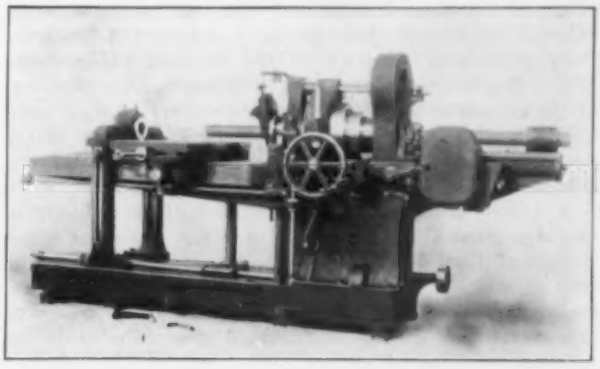


FIG. 3—THE NEW HORIZONTAL MILL.

of the machine, thus giving absolute control from either side. The table adjustment is a new feature. By the simple movement of one lever convenient to the operator when standing close to his work the table may be accurately raised or lowered by power and is capable of the finest adjustment. The cross table has a compound movement and is fitted with a power cross feed when desired. Both transverse and longitudinal screws for moving cross table are fitted with micrometer index dials reading to .001 in. The yoke for the table is of the box section form of a very rigid construction and is clamped in the table instead of by use of bolts in "T" slots. It carries double bushings for support of the boring bar. The Gisholt universal tool grinder is also on exhibition and appeals to the man interested in systematizing his tool room. The grinding of lather and planer tools under the old system by having each man do his own grinding is very unsatisfactory to many people. It takes the time of the skilled mechanics and leaves their machines idle while they are at the grindstone. The tool holder is universal in its action, permitting the operator to grind at any angle. A standard of angles may be established and every tool may be ground right.

The Baldt Steel Co., which will soon have its new plant at New Castle, Del., in operation, has increased its capital stock from $250,000 to $375,000.

Second American Trip of the Iron and Steel Institute.

The idea of a second visit of the Iron and Steel Institute to the United States had its formal beginning in a committee of the leading engineering societies of this country formed at New York in the summer of 1903. At the Barrow-in-Furness meeting of the Institute, Sept. 1 to 3, last year, Mr. C. Kirchhoff, of New York, presented the invitation on behalf of the 10,000 members of the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the Franklin Institute and the American Foundrymen's Association. It was considered especially appropriate that this visit should be made during the presidency of Mr. Carnegie. In responding to the invitation when presented at Barrow Mr. Carnegie referred to the fact that he had received the Iron and Steel Institute as chairman of the American committee at the New York meeting of 1890, adding that he little dreamt then that he should be transformed from an American into the president of the Iron and Steel Institute and in this capacity be received by Americans as a British president.

The American reception committee for the present meeting has John Fritz, of Bethlehem, Pa., as president, and the executive committee is organized with Charles Kirchhoff as chairman, Robert E. Jennings as treasurer, and Theodore Dwight, assistant secretary of the American Institute of Mining Engineers, as secretary. The honorary vice presidents of the committee are W. E. Corey, president of the United States Steel Corporation; James Gayley, president of the American Institute of Mining Engineers; Ambrose Swasey, president of the American Society of Mechanical Engineers; B. J. Arnold, president of the American Institute of Electrical Engineers; and Charles Hermany, president of the American Society of Civil Engineers. The American committee has been at work for the past year and has had in hand a task, the magnitude of which can only be appreciated by those who have performed similar functions in connection with the movement of large bodies from city to city for the inspection of works and for the gathering at first hand of practical details of works operation. The chairman and secretary of the executive committee have performed labors on behalf of the metallurgical engineers and the iron trade of the country which entitle them to the gratitude of all whom they represent. For the carrying out of plans for local reception and entertainment, committees were organized in various cities to be visited. These committees are constituted as follows:

Personnel of Local Committees.

NEW YORK.

James A. Burden, chairman, Burden Iron Co.
G. W. Maynard, vice chairman, consulting mining engineer.
Stephen W. Baldwin, treasurer, Maryland Steel Co.
C. A. Moore, Manning, Maxwell & Moore.
E. E. Olcott, mining engineer.
Thos. Robins Jr., Robins Conveying Belt Co.
H. D. Hibbard, Manganese Steel Safe Co.
L. W. Francis, Witherbee, Sherman & Co.
T. C. Martin, editor *Electrical World.*
Dr. Richard Moldenke, secretary, consulting engineer.

PHILADELPHIA.

William Sellers, chairman, Wm. Sellers & Co.
Leonard Peckitt, vice chairman, Empire Steel & Iron Co.
Walter Wood, treasurer, R. D. Wood & Co.
John Birkinbine, secretary, consulting engineer.
H. H. Campbell, Pennsylvania Steel Co.
Edwin S. Cramp, Kensington Shipyard Co.
James M. Dodge, Link Belt Engineering Co.
Stanley G. Flagg Jr., Stanley G. Flagg Co.
Alfred J. Major, American Bridge Co.
DeCourcy May, New York Shipbuilding Co.
A. J. Moxham, DeNemours DuPont Powder Co.
Frank C. Roberts, Frank C. Roberts & Co.
W. R. Webster, consulting engineer.

WASHINGTON.

Wm. B. Ridgely, controller of the currency, formerly vice president and secretary of the Springfield Iron Co., Springfield, Ill., chairman.

Dr. David T. Day, United States Geological Survey, secretary.

An honorary reception committee has been appointed consisting of Secretaries Taft, Morton, Metcalf and Hitchcock, representatives of the army and navy, Dr. Charles D. Walcott, of the Geological Survey, Geo. Westinghouse, Alexander Graham Bell, S. P. Langley, Dr. Daniel C. Gilman and others.

PITTSBURG.

Julian Kennedy, chairman, engineer.

J. M. Camp, secretary, chemist Duquesne Steel Works.

John B. Jackson, chairman finance committee, president Fidelity, Title & Trust Co.

Robert Pitcairn, chairman transportation committee, Pennsylvania railroad.

Alex. M. Jenkinson, chairman entertainment committee, R. & W. Jenkinson Co.

F. J. Torrance, chairman reception committee, Standard Sanitary Mfg. Co.

C. W. Bray, chairman program committee, American Sheet & Tin Plate Co.

CLEVELAND.

S. T. Wellman, Wellman-Seaver-Morgan Co., chairman.
A. I. Findley, editor *The Iron Trade Review,* secretary.
A. E. Brown, Brown Hoisting Machinery Co.
R. L. Ireland, M. A. Hanna & Co.
H. W. Lash, Garrett-Cromwell Engineering Co
W. G. Mather, Cleveland-Cliffs Iron Co.
Wm. McLauchlan, Pickands, Mather & Co.
J. R. Mills Jr., Carnegie Steel Co.
R. W. Ney, American Steel & Wire Co.
J. A. Penton, publisher *The Iron Trade Review.*
F. A. Scott, secretary Chamber of Commerce.
J. W. Seaver, Wellman-Seaver-Morgan Co.
W. R. Warner, Warner & Swasey Co.

BUFFALO.

T. Guilford Smith, civil engineer, chairman.
J. J. H. Brown, Chamber of Commerce.
W. Caryl Ely, International Railway Co.
Wm. B. Rankine, Niagara Falls Power Co.
Fred. C. Deming, Carnegie Steel Co.
W. H. Gratwick, Split Rock Lumber Co.
J. G. Munro, Punxsutawney Iron Co.
Maurice B. Patch, Buffalo Smelting Works.
R. H. Plumb, Buffalo Bolt Co.
E. C. Lufkin, Snow Steam Pump Co.
P. P. Pratt,
P. A. Porter Jr.
Chas. F. Dunbar.
O. P. Letchworth, Pratt & Letchworth Co.
W. A. Rogers, Rogers, Brown & Co.

Hugh Kennedy, Buffalo & Susquehanna Iron Co.
F. Howard Mason, secretary Buffalo Chamber of Commerce.
Gen. F. V. Greene, Ontario Power Co.
F. H. Goodyear, Buffalo & Susquehanna Iron Co.
Geo. L. Reis, Lackawanna Steel Co.
Richard O'Donnell, Pennsylvania Railroad Co.
E. B. Stevens, Niagara Falls Electro-Chemical Research Laboratories.
H. C. Harrower.
Geo. W. Miller, Buffalo Car Wheel Foundry Co.
Gen. Geo. S. Field.
H. J. Pierce, Wood Products Co.
S. M. Clement, Marine National Bank.
E. C. MacDougal, Bank of Buffalo.
Robert L. Fryer, Manufacturers' and Traders' Bank.
Nathaniel Rochester, 3rd National Bank.
Arthur D. Bissell, People's Bank.
George B. Forman, Fidelity Trust Co.
George F. Rand, Columbia National Bank.
C. O. McNair, Commonwealth Trust Co.
R. Emory, German and German-American Bank.
J. J. Albright, capitalist.
Edward Hayes, capitalist.
C. W. Goodyear, Buffalo & Susquehanna Coal & Iron Co.
George B. Hayes, U. S. Cast Iron Pipe Co.
R. R. Hefford, capitalist.
L. H. VanAllen, Supt. Terminals, Vanderbilt System.
Robert S. Beatty, Pennsylvania R. R.

CHICAGO.

Robert W. Hunt, Robert W. Hunt Co., chairman.
T. W. Robinson, vice president Illinois Steel Co.
E. C. Potter, formerly of Illinois Steel Co.

The Itinerary.

In another portion of this issue appears a report of the meeting at New York up to noon of Wednesday, Oct. 26. The program for the days following contemplates leaving New York Thursday morning at 10:30 via the Pennsylvania railroad, the train arriving at Philadelphia at 12:30 P. M. A party has been organized to go from New York to Bethlehem, Pa., to visit the Bethlehem Steel Co.'s plant, going thence to Philadelphia Thursday evening to join the main party. The itinerary following the stay in Philadelphia is given below:

Saturday...Oct.	29	...leave...Philadelphia.....	9:00 a. m. ..
		...arrive..Washington	..12:30 p. m....
Sunday.....	30	....	..In Washington.....
Monday	31	...leave...Washington	8:30 a. m....B. & O. R. R.
		...arrive..Cumberland	12:30 p. m....(Luncheon)
		...arrive..Pittsburgh	6:30 p. m. ..
Tuesday....Nov.	1	.....	In Pittsburgh.....
Wednesday	2	.....	
Thursday...	3	...leave...Pittsburgh.....	2:00 p. m....Penna. lines.
		...arrive..Cleveland	5:30 p. m....
Friday.....	4	.....	..In Cleveland.....
Saturday ...	5	...leave...Cleveland	1:30 p. m....L. S. & M. S.
		...arrive..Conneaut.....	3:00 p. m....
		...leave...Conneaut.....	5:30 p. m....
		...arrive..Buffalo	8:30 p. m....
Sunday.....	6 ..	.....	In Buffalo and
Monday	7...	.....	Niagara Falls.
Tuesday.....	8	...leave...Buffalo.....	8:00 a. m....N. Y. Central.
		...arrive..Syracuse	..12:00 noon...
		...arrive..Albany	4:00 p. m....
		..Electric line or N. Y. Central to Schenectady	
Wednesday	9	...leave ..Albany.....	7:00 p. m....
		...arrive..New York.....	10:30 p. m....

Program in the Various Cities.

An outline of the excursions and other forms of entertainment arranged for in the different cities is given herewith.

PHILADELPHIA.

Thursday, Oct. 27, afternoon tea at the Merion Cricket Club grounds for those who come direct from New York. In the evening an informal smoker after the Bethlehem party has returned and had dinner.

Friday, Oct. 28, three optional excursions to ship yards and other local industries, including the Baldwin Locomotive Works, and to educational institutions. In the evening a reception at the Academy of Fine Arts.

WASHINGTON.

Saturday afternoon, Oct. 29, reception of members of the Institute by President Roosevelt at the White House, followed by trips to various points of interest.

PITTSBURG.

Tuesday, Nov. 1, visit by trolley cars to the Homestead works of the Carnegie Steel Co. Lunch served on cars en route to Duquesne Steel Works, which will be visited in the afternoon. In the evening a reception will be given the visitors in the Hotel Schenley.

Wednesday, Nov. 2, visit to Edgar Thomson Works of the Carnegie Steel Co., with lunch. In the afternoon the party goes to East Pittsburg to visit the plant of the Westinghouse Works, where an informal reception will be given in the evening.

Thursday, Nov. 3, at the disposal of the visitors.

CLEVELAND.

Friday, Nov. 4, a special train will take the party to the Newburg works of the American Steel & Wire Co., where lunch will be served. In the afternoon the Central furnaces of the same company will be visited, and later the N. Y. P. & O. and Cleveland and Pittsburg ore docks. Special entertainment will be provided for the ladies on Friday, consisting of carriage rides through the parks and boulevards, with lunch at the Euclid Club and a reception following. On Friday evening a complimentary banquet will be given the visitors in the assembly hall of the Chamber of Commerce.

Saturday, Nov. 5, optional excursions to iron and steel plants and engineering metal working establishments.

BUFFALO.

Monday, Nov. 7, excursions to Niagara Falls, to power plants and to other points in and about Buffalo.

ST. LOUIS AND CHICAGO.

Those of the visitors (the number is about 90) who leave the main party at Pittsburg will go to St. Louis in a special train, spending Friday afternoon, Saturday and all of Monday at the Exposition. Leaving St. Louis Monday night the party reach Chicago Tuesday morning. No program has been arranged for the forenoon of that day, the visitors being given that opportunity to rest and to secure hotel accommodations. In the afternoon, the option will be given of a trip through the Illinois underground tunnel, a visit to the stock yards, or the inspection of the Fiske street power station. This will be followed by a theatre party in the evening, with supper afterwards at the Chicago Athletic Club. Wednesday morning, the gentlemen will be taken to South Chicago through the works of the Illinois Steel Co., where lunch will be served by the company at noon. At 10 o'clock of that morning, the ladies will leave for an automobile ride through the parks and boulevards of the city as the guests of the wives of the members of the local reception committee. Lunch will be served at the Washington Park Club. No program has been arranged for Wednesday afternoon, owing to the fact that the Institute members and their ladies must leave for the East on the 6 o'clock train, but if there is time other points of interest will be visited. On the return trip to New York the St. Louis party will visit Buffalo and Niagara Falls. The sailing day is Saturday, Nov. 12, though some of the main party may reach New York in time to sail on Wednesday, Nov. 9.

History of the Iron and Steel Institute, with Sketches of Some of Its Leading Members.

(With Supplement.)

The Iron and Steel Institute was founded in 1869, with the object of affording means of communication between members of the iron trade upon matters bearing upon iron manufacture, excluding all questions connected with wages and trade regulations.

Another declared object of the founders was to arrange periodical meetings for the discussion of practical and scientific subjects bearing upon the manufacture and working of iron and steel. While the membership of the Institute is very largely in Great Britain, the fact is that there are members in all the iron and steel producing countries of the world. Out of about 1,900 members, 424 are in countries apart from Great Britain. The membership in the United States is 137; in Austria-Hungary, 13; in Belgium, 24; in France, 47; in the German Empire, 60; in Sweden, 60; in Russia, 11; in Italy, 11; in India, 12; in Spain, 24. The statistics of the British iron trade are gathered by the British Iron Trade Association, which also has for its province questions pertaining to the economics of the British iron trade. Fiscal and commercial questions have no place in the deliberations of the Iron and Steel Institute, while wage questions, where they are handled by associations, belong to various local organizations.

Two general meetings of the Institute are usually held in each year, one of which is in London in May, and the other in the autumn in such locality as the council directs. Meetings held outside of Great Britain are the following: Liege, Belgium, 1873; Paris, 1878; Düsseldorf, 1880; Vienna, 1882; Paris, 1889; New York, 1890; Brussels, 1894; Bilbao, 1896; Stockholm, 1898; Paris, 1900; Düsseldorf, 1902; New York, 1904.

A periodical journal of the Institute is issued at intervals of six months. In addition to reprinting papers read at the various meetings, the journal gives abstracts of papers relating to iron and steel, published in scientific and technical journals and in the transactions of other associations. The total number of papers read by the Institute from 1869 to 1903 is 679. Accompanying these have been 1,304 illustrations, and the journal from 1869 to 1903 has contained a total of 33,338 pages. The presidents of the Institute since its establishment have been as follows:

The Duke of Devonshire, K. G., 1869-71. (Deceased.)
Sir Henry Bessemer, F. R. S., 1871-73. (Deceased.)
Sir Lowthian Bell, Bart., F. R. S., 1873-75
W. Menelaus, 1875-77. (Deceased.)
Sir C. William Siemens, F. R. S., 1877-79. (Deceased.)
Edward Williams, 1879-81. (Deceased.)
Josiah Timmis Smith, 1881-83.
The Right Hon. Sir Bernard Samuelson, Bart., F. R. S., 1883-85.
John Percy, M. D., F. R. S., 1885-87. (Deceased.)
Daniel Adamson, 1887-89. (Deceased.)
Sir James Kitson, Bart., M. P., 1889-91.
Sir Frederick Augustus Abel, Bart., K. C. B., F. R S., 1891-93. (Deceased.)
Ed. Windsor Richards, 1893-95.
Sir David Dale, Bart., D. C. L., 1895-97.
Ed. Pritchard Martin, 1897-99.
Sir William C. Roberts-Austen, K. C. B., 1899-01. (Deceased.)
William Whitwell, 1901-03.
Andrew Carnegie, LL. D., 1903.

There have been three secretaries, John Jones serving from 1869 to 1877; James Stephen Jeans, the accomplished editor of the *Iron and Coal Trades Review*, of London, from 1877 to 1893; and Bennett H. Brough from the latter date. Mr. Brough has acted as editor of the foreign abstracts for the journal since 1884.

In 1873 Sir (then Mr.) Henry Bessemer invested £400 in securities, the income from which was to procure annually a gold medal, to be awarded by the Council of the Institute. The awards are to be: (1) to the inventor or introducer of any important or remarkable invention, either in the mechanical or chemical processes employed in the manufacture of iron or steel; (2) for a paper read before the Institute, and having special merit and importance in connection with the iron and steel manufacture; (3) for a contribution to the Journal of the Institute, being an original investigation bearing on the iron and steel manufacture, and capable of being productive of valuable practical results.

Since the medal was instituted the awards have been as follows:

1874. Sir Lowthian Bell, Bart., F. R. S.
1875. Sir C. William Siemens, F. R. S.
1876 Robert Forester Mushet.
1877. John Percy, M. D., F. R. S.
1878. Peter Ritter von Tunner.
1879. Peter Cooper.
1880. Sir Joseph Whitworth, Bart.
1881. William Menelaus.
1882. Alexander Lyman Holley.
1883. George James Snelus, F. R. S.
1883. Sidney Gilchrist Thomas.
1884. Edward Windsor Richards.
1884. Edward Pritchard Martin.
1885. Richard Akerman.
1886. Edward Williams.
1887. James Riley.
1888. Daniel Adamson.
1889. John Devonshire Ellis.
1889. Henri Schneider.
1890. William Daniel Allen.
1890. Hon. Abram S. Hewitt.
1891. The Right Hon. Lord Armstrong, C. B., F. R. S.
1892. Arthur Cooper.
1893. John Fritz.
1894. John Gjers.
1895. Henry Marion Howe.
1896. Hermann Wedding.
1897. Sir Frederick A. Abel, Bart., K. C. B., F. R. S.
1898. Richard Price-Williams.
1899. Her Majesty, Queen Victoria.
1900. Henri De Wendel.
1901. John Edward Stead.
1902. His Excellency, Friederich, Alfred Krupp.
1903. Sir James Kitson, Bart., M. P.
1904. Robert Abbott Hadfield.

It will be noticed that five Americans have been honored with the Bessemer medal, namely, Peter Cooper, Alexander L. Holley, Abram S. Hewitt, John Fritz and Henry M. Howe.

Andrew Carnegie, in 1902, founded the Carnegie Research Scholarships, presenting to the Institute 64 $1,000 Pittsburg, Bessemer & Lake Erie Railroad Co. 5 percent debenture bonds. The scholarships are awarded by the council to enable students who have passed through a college curriculum, or

have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel, with the view of aiding its advance or its application to industry. The appointment to a scholarship is for one year, but the council may renew it for a further period. The results of the research are communicated to the Iron and Steel Institute in the form of a paper to be submitted to the annual meeting of members, and if the council considers the paper to be of sufficient merit, the Andrew Carnegie gold medal is awarded on its authority. In 1903 the Andrew Carnegie gold medal was awarded to Alfred Campion, and a special silver medal was awarded to Octave Boudouard. In 1904 it was awarded to Pierre Breuil (Paris), and a special silver medal was awarded to P. Longmuir (Sheffield). Five scholarships, each of the value of £100, were awarded in 1904 to John D. Brunton (Musselburgh), H. C. H. Carpenter (Teddington), E. G. L. Roberts, jointly with Ernest A. Wraight (London), Frank Rogers (Cambridge), and Walter Rosenhain (Birmingham). An additional grant of £50 was awarded to Octave Boudouard.

The Visiting Party.

A strong and representative body of members of the Iron and Steel Institute is now in the United States for the New York meeting and the visits to iron and steel centers that are to follow. The party numbers about 200 members, including manufacturers, engineers, metallurgists, representing almost every branch of the British iron and steel industry, while a number of members from the Continent of Europe, and not a few American members, serve to emphasize again the international scope of the work of the Institute. The following is a revised list of members who have come across the water in the past week. In addition to members there are about 75 ladies in the party:

C. Allen, W. B. Allen, Thos. Atherton.

Andrew Bain, C. H. F. Bagley, W. R. Bates and Mrs. Bates, Prof. H. Bauerman, T. R. Bayliss and two ladies, W. F. Beardshaw, L. Beijer, J. and Mrs. Bertram, Henry Birkbeck, Geo. G. Blackwell, A. W. Blackwell and two ladies and son, J. M. Blair and one lady; C. E. Bloomer, J. E. Alger Blyde, Edwin Bond, A. Booth and one lady, Wm. Booth and Mrs. Booth, Wm. Bright, Miss Margaret Bright, Miss Margaret Evans and Miss Amy Evans, B. J. Broadway and Miss Broadway, B. H. Brough (secretary), J. Dixon Brunton and one lady, C. E. Bunch and one lady, H. Butler, R. W. Burnyeat.

Thos. Campbell and one lady, E. Carlisle, T. Carlisle, A. Carnegie and Mrs. Carnegie, L. Cassier and Mrs. Cassier, George Cawley, E. C. Chalas and Mrs. Chalas, P. Chamfrault, E. D. Cleghorn, A. Colley, Lieut.-Col. J. H. Cowan and Miss Melvin, P. N. Cunningham and Miss Cunningham, J. C. Custodis.

W. S. Davie and one lady, Harry Davies, W. H. Davies, V. J. Diefenderfer, H. S. Downe, E. Dreux, E. J. Duff and one lady, James Duffield, N. Duffield, G. R. Dunell.

G Ekman, C. K. Everitt.

E. Farnworth and Mrs. Farnworth, John Fellows, A. Firth, D. Flather, Sir Walter Foster, M. P., G. E. Fox.

H. G. Graves, G. Watson Gray and Mrs. Watson Gray.

John Hardisty, W. R. Hay and Mrs. Hay, A. P. Head and Mrs. Head, W. Hill, A. J. Hobson and Miss Amy Hobson, H. E. Hodgson and Mrs. Hodgson, Wm. Hodgson and Mrs. Hodgson, A. Hosfield, S. E. Howell and Mrs. Howell. Herbert Hughes and Misses Hughes, J. C. W. Humfrey, Samuel Huxley.

C. W. James, Thos. Jenkins, C. L. Jones, E. Peter Jones and two ladies.

R. W. Kennard, James Kerr and Miss Kerr, J. Kidner and Miss Kidner, Sir James Kitson, M. P., two ladies and son, R. D. Kitson.

W. J. Larke, L. N. Ledingham, A. J. Ledwith, John Lees, John Bayley Lees, A. Lennox Leigh, David Lewis and Mrs. Lewis, W. R. Lewis, J. Little, J. Livesey, F. H. Lloyd, J. F. S. Lloyd and son, A. H. Longden, D. A. Louis, D. C. Lysaght.

Cumming Macdona, M. P., T. B. MacKenzie, R. C. McKerrow, C. F. MacLaren, W. S. B. MacLaren, George MacMillan and Mrs. MacMillan, M. Magery, J. Magery, P. J. Mallmann, H. P. Marsh, E. P. Martin, Hugh Martin and one lady, H. F. Massey, W. H. Massey, Miss Massey, H. Mechan, Mrs. Mechan, R. Melhuish, A. C. Meyjes and one lady, J. T. Middleton, S. V. Morgan.

C. T. Needham and Mrs. Needham, D. M. Nesbit, F. Noake, T. Noda.

Halsall, Owen.

J. Paterson, V. Pendred, A. E. Pettit, R. Price-Williams, J. Proctor, A. S. Pye-Smith.

J. Raine and Mrs. Raine, B. M. Renton and Mrs. Renton, Alleyne Reynolds, E. Windsor Richards, David E. Roberts, R. Roberts, W. B. Roberts and Mrs. Roberts, L. S. Robertson, Sydney J. Robinson and Mrs. Robinson, T. B. Rogerson and Mrs. Rogerson, F. T. Rollin and Miss Rollin, R. Russell and Mrs. Russell.

A. Sahlin and Mrs. Sahlin, E. H. Saniter, F. Sauer, G. Scarf, P. Schmidt, H. Kilburn Scott, E. G. Sehmer and one lady, George E. Senior and Mrs. Senior and Miss Senior, A. G. Service and Mrs. Service, L. P. Sidney, F. C. Siemens, H. C. Simpson, D. T. Sims, Enos Smith and Mrs. Smith, G. H. Smith, Mrs. Smith, R. Sneddon, E. Steiger, S. E. Stevens and Mrs. Stevens, Sir David Stewart, C. B. C. Storey and Mrs. Story, E. Stordy and one lady, T. W. P. Storey, S. J. Summerson, T. Symington, R. Sharp

B. Talbot and Miss Talbot, H. F. J. Taylor, Hubert S. Thomas, F. Timmermans, John Timms, J. E. Touch, William Tozer, A. Turnbull, H. G. Turner, T. Turner.

J. Verity, A. Vosmaer.

H. H. Wake, R. Wallwork, Mrs. Wallwork and Miss Wallwork, M. Wardlow, H. C. Waterson, H. B. Weeks, Dr. A. Weiskopf and Mrs. Weiskopf, T. Westgarth, G. H. White, R. Whitehead, W. Whitwell, F. H. Wigham and one lady, F. D. Wild, T. Wilkinson and Mrs. Wilkinson, Wilfred Williams, R. Williamson, Col. R. S. Williamson, G. P. Wincott, Sir Lloyd Wise and Lady Wise, W. W. Wood Jr., J. Wood and Mrs. Wood, R. G. Woodward.

S. Young and Mrs. Young.

Heinrich Zix.

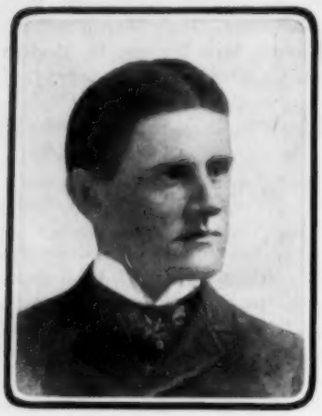
Representative Members and Officers.

Below are given some data concerning the achievements of a number of leading members of the Institute, the list including both visiting members and members who did not go on the American trip:

Sir David Dale.

Sir David Dale, one of the past presidents of the Institute, who is in the visiting party, comes of a family several of whose members have been distinguished in British industry and commerce. His business training was obtained by passing through the various departments of the Stockton & Darlington railway, and he was for some years managing director of the Darlington section of the North Eastern railway. In 1872 he became managing partner of the firm afterwards known as Pease & Partners, Ltd., controlling extensive coal and iron mines. When the great iron works at Consett passed into control of the Consett Iron Co., Ltd., Sir David became a managing director and subsequently chairman, which position he still holds. He is also chairman of the Consett Spanish Ore Co., Ltd., and of the Orconera Iron Ore Co., Ltd., the latter being the most important of the companies working mines of hematite ore near Bilbao, in the north of Spain. He is connected in an important capacity with the North Eastern Railway Co. and a director of the Barrow Hematite Steel Co., Ltd. He was treasurer of the Iron and Steel Institute from 1869 to 1895, being elected president in

the latter year. He is chairman of the joint committee of Cleveland mine owners and miners as well as chairman of the Durham Coal Trade Conciliation Board. As referee of the Board of Arbitration and Conciliation for the North of England manufactured iron and steel trades he has rendered important service. He was a British representative at the Berlin Labor Conference in 1890 and recently was chairman of one of the three sections into which the Royal Commission of Labor was divided.



W. P. RIDGELY,
Chairman Washington Committee.

E. Windsor Richards.

Mr. Richards is a past president of the Institute. He was from 1876 to 1886 general manager and is now chairman of the famous Cleveland firm of Bolckow-Vaughan & Co., Ltd. His youngest son, Arthur Windsor Richards has just been appointed assistant general manager. Mr. Richards received an excellent training in mechanical and metallurgical engineering in South Wales, his native country. In recognition of his valuable service in steel metallurgy he has received the Bessemer gold medal. During his supervision of the Bulckow-Vaughan Works he was closely connected with the application of the basic process, which has made so available the high phosphorus ores of Cleveland, Luxemburg and Alsace-Lorraine. As far back as 1872 G. J. Snelus had made experiments which proved to his satisfaction that phosphorus was eliminated in the presence of a basic lining. His discovery was not made public until 1878, when Mr. Sidney G. Thomas announced his independent discovery of the same fact at the meeting of the Iron and Steel Institute. Mr. Thomas secured the co-operation of Mr. Richards, who, with the approval of his directors, erected at the Eston Steel Works a plant especially adapted to the new system. Mr. Richards was president of the Institute from 1893 to 1895.

E. P. Martin.

Edward Pritchard Martin, one of the visiting members of the Institute, was born at Dowlais in 1844. In 1860 he began work under the late William Menelaus and Edward Williams, with the Dowlais Iron Co. In 1869 he became deputy general manager of the company. In 1874, as general manager of the Blen Avon Co.'s works, he identified himself with the inventions of Thomas and Gilchrist, working at the dephosphorizing of steel, and for his services in this connection he received the Bessemer medal. In 1882 he became general manager of the Dowlais Iron Co. and erected the new steel works at Cardiff. On the amalgamation of the Dowlais Iron Co. with the Patent Nut & Bolt Co. he was appointed deputy chairman and managing director of Guest, Keen & Co. He retired from this position in 1902, but is still a director of Guest, Keen & Nettlefgolds, Ltd. He is a past president of the Iron and Steel Institute and of the South Wales Institute of Engineers; vice president of the Institution of Mechanical Engineers and member of the Institution of Civil Engineers.

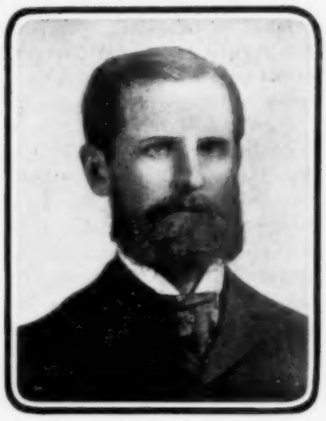
CHAS. KIRCHHOFF,
Chairman Executive Committee.

Sir James Kitson.

One of the most prominent of the members of the Institute who is visiting the United States this year is Sir James Kitson, Bart., M. P. He has been for many years active in the affairs of the Institute and taken a leading part at most of its meetings. He presided at the Paris meeting in 1889; also at the meetings in New York and Pittsburg on the occasion of the last visit of the Institute to the United States in 1890. Sir James is the second son of the late James Kitson, founder of the locomotive works now operated at Airedale Foundry, Leeds, by Kitson & Co., Ltd. These works were begun in 1839. Sir James Kitson's industrial work began at the Monk Bridge Iron & Steel Works, of which he has been principal manager since 1854. These works manufacture Yorkshire iron and crucible and open-hearth steel. Sir James and his brother, F. W. Kitson, were patentees of the method for manufacturing solid weldless tires which were produced in large quantities for many years until superseded by steel tires. In 1862 the manufacture of steel tires was begun at the Monk Bridge Iron Works and Sir James Kitson's company continues the business, which is now one of the foremost of its class in the United Kingdom.

Wm. Beardmore.

William Beardmore, a member of the council of the Institute, was born in London, but his earlier years were spent in Scotland. He began work at Parkhead Forge at the age of 14, and is now at the head of this extensive plant. He left the forge after several years as an apprentice, and attended the South Kensington School of Mines for two and a half years. In 1886 Parkhead Forge was chiefly employed on ship and general work, but Mr. Beardmore essayed armor plate manufacture and patented a process of his own which has been entirely successful. He has clad cruisers, destroyers and battleships for the British admiralty and the navies of Holland, Italy and Japan. The output of this forge amounts to over $5,000,000 a year in value, and has been steadily increasing. The works have been extended from time to time, and the crowded plant and yards now take up 30 acres, to which 12 acres have lately been added. Mr. Beardmore's firm recently acquired the shipbuilding and engineering business of R. Napier & Sons at Govan and Lancefield. Over 70 acres of ground have been taken up at Dalmuir, to which these works will ultimately be transferred. The new plant will be on a scale permitting of undertaking the largest battleships, cruisers and mail steamers.



DR. DAVID T. DAY,
Secretary Washington Committee.

J. M. White.

A well known member of the council but not one of the visitors is J. M. While, general manager for the past 12 years of the Barrow Hematite Steel Co.'s works. In the early '70's Mr. While had charge of roll turning at Gorton works of Bolckow, Vaughan & Co. and had a contract for the entire manufacture of steel rails. Later he was with the Dowlais Iron Co. and the Darlington Steel & Iron Works. Mr. While patented a system generally used today for rolling tram rails, a vertical roll being placed on the same axis imme-

diately between the journals of the horizontal rolls. He was first to use skids for conveying rails along the hot bank. A number of other of his mechanical improvements are in use at Barrow. By rebuilding on modern lines the Bessemer works at Barrow, providing soaking pits and a new method of conveyance to the rolls, Mr. While has effected a large saving in the cost of manufacture. Very extensive improvements at this plant were inspected by the Institute while on its visit to Barrow in 1903, these being completed in nine months from the date the directors decided to do the work.

C. J. Snelus.

George J. Snelus was born in Camden Town, June 25, 1837. Among his early appointments was that of manager of the Bessemer Steel Works at West Cumberland. In March, 1872, he took out a patent on the employment of basic linings in furnaces and crucibles and made the first piece of basic metal. In this patent he joined Sidney Thomas and James Riley seven years later, and though patents were secured only in England and the United States, Mr. Snelus drew about $175,000 as his share of the royalties. In 1871 he was sent to the United States as expert on behalf of the Iron and Steel Institute to report fully on the Danks puddling furnace. In the early '70's he became general manager of the Bessemer Steel Works at West Cumberland, remaining in this position until 1890. In 1883 he received the Bessemer gold medal for being "the first to produce Bessemer steel by the basic process." At the same time a medal was awarded to Mr. Thomas.

ROBT. W. HUNT,
Chairman Chicago Committee.

In the past three years Mr. Snelus, whose contributions to the proceedings of the Institute have been numerous and important, has taken out patents for making steel direct from the furnace by means of a rotary converter heated by the waste gases from the blast furnace and the hot blast. He also has a patent on converting the waste gases from the blast furnace into useful gas by passing the waste gas through a vertical regenerator. The Distington Iron Co. has put up a ten-ton rotator to test the first process, which also covers the making of a refined iron. It is expected that this process will be tried in a short time. Mr. Snelus claims a better yield on it than at present possible by the Talbot process. In 1881 Mr. Snelus was elected a member of the council of the Institute, and in 1889 a vice president. He was made a fellow of the Royal Society in 1887.

David Evans.

Born at Aberdare, Glamorganshire, in 1841, David Evans passed his youth and early manhood in an atmosphere of metallurgy. His first training was obtained at the Aberdare Iron Works, and at 25 he succeeded his father as blast furnace manager there. He accepted the post of works manager at the Edw. Vale Iron & Steel Co.'s blast furnaces, forges and mills in 1875. From 1878 to 1885 he was general and resident manager at furnaces, mills and forges at Rhymney and from 1885 to 1891 was general manager at the Barrow Hematite Iron & Steel Co. In 1891 he became general manager for Bolckow, Vaughan & Co., Ltd., Middlesbrough. This company has coal mines producing about 2,000,000 tons a year; also large coking plants and limestone quarries. Its iron mines producing about 2,000,000 tons a year are in the Cleveland hills, not far from the works. There are 24 blast furnaces, of which 17 are active, making about 2,000,000 tons a day of Cleveland basic and hematite pig iron. The company's steel works, with an output of about 1,000 tons a day, have ten Bessemer converters, ten open-hearth furnaces, with blooming mills, plate mills, rail and merchant mills. The company also operates a steel foundry and engineering shops. Large supplies of iron ore are also drawn from the company's mines near Bilbao, Spain. The total number of men employed in all its operations is 13,500. Mr. Evans is a past president of the Cleveland Iron Masters' Association and a member of various engineering associations, including the American Institute of Mining Engineers. He is a member of the Institute of Naval Architects and representative of the steel makers of England and Wales on Lloyds committee.

W. E. COREY,
Honorary Vice President.

Axel Sahlin.

A member of the Institute well known on both sides of the Atlantic is Axel Sahlin, mechanical engineer and metallurgical expert. He was born and educated in Sweden, his ancestors for several generations being iron masters and mine owners. He served his apprenticeship on the Swedish Government railways and inspected material on the Continent and in England. He came to the United States in the early eighties and was employed by the Cambria Iron Co., later by the Pottstown Iron Co., the International Ore Separating Co. and the Maryland Steel Co., becoming general superintendent of the last named. He left this position to represent the Brown Hoisting Machinery Co., of Cleveland, in Europe. Later he became general superintendent of the Millom & Askam Hematite Iron Co., Ltd., at Barrow-in--Furness. In 1901 he came to the United States as a member of the commission of experts sent by the British Iron Trade Association to investigate and report on progress in the manufacture of iron and steel in this country. Mr. Sahlin is a member of the London engineering firm of Julian Kennedy, Sahlin & Co. In the list of his achievements has been his success in operating old English blast furnaces under comparatively high pressure, with a reasonable coke consumption and cheap labor cost, the output being an iron running as low as 0.5 percent silicon, with sulphur 0.03 percent.

Sir Alfred Hickman.

Sir Alfred Hickman is one of the chief iron manufacturers and colliery proprietors and one of the largest employers of labor in England. He is a past president of the British Iron Trade Association and a member of the Council of the Institute; also of the Associated Chambers of Commerce and of the Mining Association of Great Britain. He has been for many years the largest maker of pig iron and steel in the Midlands. He has always taken an important part in questions arising between railways and shipoers and rendered good

THEO. DWIGHT,
Secretary General Committee.

service to the iron trade in 1889 and 1890 in this connection. He is chairman of the Alfred Hickman Co., Ltd.

Sir Lowthian Bell, Bart.

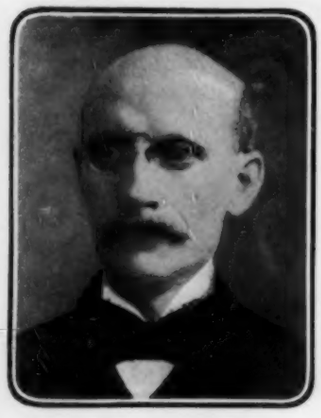
Among the prominent members of the Institute who are not visiting the United States this fall is Sir Lowthian Bell, Bart., who with his two brothers, Thomas and John, founded the famous firm of Bell Bros., Clarence Iron Works, Middlesborough, now a limited company. Sir Lowthian is a past president of the Institute and is the author of "The Chemistry of the Blast Furnace" and "Principles of the Manufacture of Iron and Steel." He is still a hale and hearty octogenarian and has just been elected president of the Institute of Mining Engineers.

S. T. WELLMAN,
Chairman Cleveland Committee.

Sir Lowthian is undoubtedly the greatest living authority in Great Britain on blast furnace practice. He was born in the neighborhood of Newcastle and passed his early school days in that district. He subsequently visited France, Germany and Denmark for the purpose of acquiring the languages and making himself acquainted with the scientific progress of those countries. The iron ores of the Cleveland district contain more phosphorus than was compatible with the production of good steel, and with the economical removal of phosphorus from the pig iron produced from local ores, Sir Lowthian busied himself for years. He and his firm spent thousands of pounds over the problem. The solution of which, however, fell to the inventors of the Thomas-Gilchrist process. Steel is now produced from Cleveland iron at the Clarence Steel Works. Sir Lowthian is joint trustee with Sir David Dale, of the Bessemer Medal fund.

Sir E. H. Carbutt.

Sir E. H. Carbutt, Bart., is a member of the council of the Institute. He is a J. P. and deputy lieutenant for the county of Surrey. He was born in 1838 and at the age of twenty-three joined the firm of Thwaites & Carbutt, Bradford, makers of steam hammers, rolling mills and machinery for iron and steel works. After inspecting the Roots blower shown in the American section of the Paris Exhibition, he took up its manufacture, being convinced that it was a considerable improvement in pressure blast machinery. He retired from the above firm in 1877 and has since devoted himself to public affairs.



JAMES GAYLEY,
Honorary Vice President.

P. C. Gilchrist.

Percy Gilchrist, F. R. S., is a vice president of the Institute. In May, 1879, in conjunction with the late Sidney Gilchrist Thomas he read a paper before the Iron and Steel Institute entitled "The Elimination of Phosphorus in the Bessemer Converter." The process described in this paper is now called the basic Bessemer or Thomas-Gilchrist process, and a very considerable percentage of the steel of Germany and Great Britain is produced under it. The country which has benefited most by the process is Germany, two-thirds of her steel ingot production being by basic Bessemer.

George Ainsworth.

George Ainsworth was for three years in the early part of his career chemist to the late West Cumberland Hematite Iron & Steel Co. He has been for thirty-three years with the Consett Iron Co., Durham, successively as chemist, manager of the blast furnaces and open-hearth plants, general works manager, and finally general manager. He became a member of the Institute in 1872 and was elected a member of the council in 1889.

James Riley.

One of the vice-presidents of the Institute is James Riley, proprietor of the Richmond Iron Works, Stockton-on-Tees. He was born in 1840 and after receiving a fair education at a local school was for some years employed as a millwright and engineer. His ability soon brought him to the front and in 1869 he was appointed to the management of the blast furnaces of the Askam Iron & Steel Co., Barrow-on-Furness. In 1872 he assumed charge of the blast furnaces of the Landore Siemens Steel Co. and the Hirwain furnaces, near Aberdare. At these latter furnaces he succeeded in producing spiegeleisen from the manganiferous ores of the south of Spain. This was at the time of the Franco-German war, when there was a spiegeleisen famine. In 1874 Mr. Riley was appointed manager of the Landore Co. and was thus brought into direct connection with the late Sir W. Siemens. He was able, by the employment of ferro-manganese in a modified form, to improve the steel greatly as regards softness and ductility, and it was largely owing to him that mild steel became generally adapted for naval and other purposes. He induced tin plate manufacturers to give it a trial and also the admiralty, excellent results following. In 1878 Mr. Riley became general manager of the Steel Co. of Scotland, and popularized mild steel with the shipbuilders of the Clyde, as well as introducing it for boiler making and other purposes. In 1887 the Iron and Steel Institute presented him the Bessemer gold medal. Subsequently Mr. Riley became general manager of the Glasgow Iron & Steel Co., a position which he resigned in 1899.

JULIAN KENNEDY,
Chairman Pittsburg Committee.

William Whitwell.

Mr. William Whitwell, one of the visiting party, is a past president of the Institute, and occupies a position of considerable influence in the iron and steel trades of Great Britain, having extensive iron works at Thornaby-on-Tees, and being president of the Board of Conciliation and Arbitration of the North of England Iron and Steel Trades. He was born at Kendal, Westmoreland, in 1835. He is both a magistrate and a deputy lieutenant for the North Riding of Yorkshire.

R. A. Hadfield.

Robert A. Hadfield, who is not now visiting the United States, showed a taste for chemical and metallurgical research at a very early age and is the author of an admirable series of papers on iron alloys. One of his chief claims to distinction is his discovery and commercial development of manganese steel, and he has made many other contributions to the progress of steel metallurgy. He is the chairman and

managing director of Hadfield's Steel Foundry Co., Ltd., whose works cover an area of about 90 acres and give employment to from 3,000 to 4,000 workmen. The foundry of the company is a very large one, being over 1,000 ft. in length with an area of nearly 300,000 square feet.

T. Westgarth.

Mr. Tom Westgarth, one of the visitors, is joint managing director of Richardsons, Westgarth & Co., Ltd., one of the largest engine building firms in the United Kingdom, controlling the Middlesbrough branch of their works. The business of the firm is largely marine engine building, but they make a specialty of steam turbines, gas engines, blowing engines and steel works plant, the firm being the pioneers in England of large size gas engines for blast furnace gas, and the largest makers in the United Kingdom of this class of machinery. Mr. Westgarth is now designing and building a completely new rolling mill plant of large size for the Cargo Fleet Iron Co., Ltd., of Middlesbrough. Mr. Westgarth is a member of most of the leading scientific institutes in England, and has presented many papers. He is vice president of the Northeast Coast Association of Engineers and Shipbuilders and a past president of the Cleveland Institute of Engineers.

R. Price-Williams.

R. Price-Williams, was recently the recipient of the Bessemer gold medal, and since them he has been awarded the Stephenson gold medal of the Institute of Civil Engineers. He has made eight journeys to Austrialia and during his visits there has been engaged professionally in examining and reporting upon the condition of the railways in New South Wales. He has also made frequent visits to the United States and examined and reported upon railways in Kansas and Texas.

DR. R. MOLDENKE,
Secretary New York Committee.

Benjamin Talbot.

Benjamin Talbot, who is a member of the Iron and Steel Institute party, is the inventor of the continuous process of making steel which bears his name. He was born in 1864, and went to the United States in 1890. He first managed a steel works at Chattanooga, Tenn., and in 1893 went to the Pencoyd works at Philadelphia as manager. In 1900 he returned to England to introduce the continuous process which he had meanwhile invented. He has also invented a mechanical gas producer and has made several improvements in open-hearth and reheating furnaces. In May, 1900, he read a paper before the Institute describing his continuous process.

Bennett H. Brough.

Mr. Brough is the secretary of the Iron and Steel Institute. He was educated at the Royal School of Mines, London, and at the Royal Prussian Mining Academy at Clausthal in the Hartz Mountains. He was formerly instructor in mine surveying at the Royal School of Mines, and is the author of the standard English treatise on mine surveying (1st edition 1888, 10th edition 1903). He was appointed co-editor of the Journal of the Iron and Steel Institute in 1884 and secretary on Feb. 24, 1903. He is a knight of the Swedish Order of Wasa, an associate of the Royal School of Mines, a fellow of the geological society, and a member of council of the Institution of Mining Engineers. He has also served on the councils of the Institute of Chemistry and of the Chemical Society. He served as juror at the Inventions Exhibition in London in 1885 and at the Paris Exhibition of 1900. He received a medal for the collection illustrating the mineral resources of Great Britain, formed by him at the request of the Royal Commission for the Chicago Exposition of 1893. He delivered before the Society of Arts courses of lectures on mine surveying (1892), on metalliferous deposits (1900), and on non-metallic minerals (1903), which have been published in book form, and he is the author of numerous papers on mining and metallurgy.

AMBROSE SWASEY,
Honorary Vice President.

Leicester P. Sidney.

Mr. Sidney is the assistant secretary of the Iron and Steel Institute. He was born in 1871 and educated partly at the Ecole Communal de Boulogne sur Mer, and partly at Brighton. On leaving college he entered the laboratory of the South Staffordshire Steel Ingot Co. at Bilston, and subsequently became chief chemist at the works of the Shelton Iron, Steel & Coal Co., Stoke-on-Trent, where he was associated during a part of the time with the management of the smelting department. While in Staffordshire he took a prominent part in the social, literary and scientific life of the district. In 1896 he went to London where he joined the staff of the *Iron and Coal Trades Review*, which he left in 1899 to become reader and technical editor to the publishing firm of Charles Griffin & Co. Mr. Sidney, who was appointed assistant to Mr. Brough in May last, is the author of numerous papers, short stories, etc.

J. T. Smith.

Josiah Timmis Smith, a past president of the Institute, is descended from an old family connected with the iron trade of Yorkshire and Derbyshire. He was associated with the late S. H. Blackwell in Staffordshire at the time of his discovery of the ores of Northamptonshire and working out their practical utility for the manufacture of iron. In 1859 he settled at Barrow-in-Furness and erected there works which, under his management, became among the largest and most successful in the world. In 1881 he became president of the Iron and Steel Institute and afterward of the British Iron Trade Association. He is the author of a paper on "The Iron Ore Resources of the World," which attracted much attention and drew the friendly criticism of Abram S. Hewitt and other American experts. In 1885 Mr. Smith became chairman of the Steel Rail Makers' Association, which included the makers of Germany and Belgium as well as those of Great Britain and lasted about three years. Mr. Smith retired from the Barrow works some years ago but is still connected in one way or another with various iron trade enterprises.

JOHN BIRKINBINE,
Secretary Philadelphia Committee.

J. E. Stead.

One of the very prominent members of the Institute, who is not one of the visitors, is J. E. Stead, one of the most prolific contributors to the scientific discussion of iron and steel manufacture. He was for a time chemist to Bolckow Vaughan & Co. but afterwards entered into partnership with

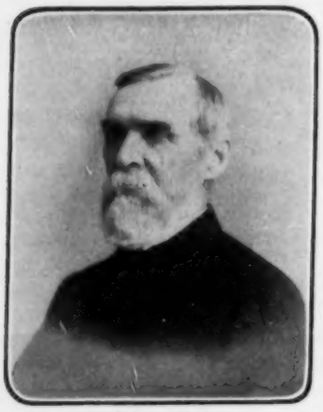
his first employer, Mr. Parkinson, at Middlesbrough. In 1901 he was awarded the Bessemer gold medal by the Institute. His contributions to metallography have been numerous and important. His recent investigation in relation to the microscopic detection of those constituents in which the phosphorus present in iron and steel segregates are generally recognized as being of very considerable importance.

Benjamin Howard Thwaite.

Having visited the United States last year, Mr. Thwaite is not with the present party. He was one of the pioneers in Great Britain of the project for transmitting producer gas (from a coal field generating station) at high pressure for working gas engines. In 1894 he invented a process by which the waste gases from blast furnaces were utilized for generating power in internal combustion engines, and advanced the theory that the future role of the iron making blast furnace might include the generation of cheap electrical energy for distribution to areas of electrical demand 30 miles round the furnaces.

A. T. Tannett-Walker.

Arthur T. Tannett-Walker is a member of the council of the Institute, and a governing director of Tannett-Walker & Co., Ltd., Leeds. He has long been associated with the designing and manufacture of all kinds of machinery used in the manufacture of iron and steel. His company was an early maker of the special machinery used for the Bessemer and the Thomas-Gilchrist processes. Steam hammers and mills and machinery of the largest type have been made by the company for the great iron and steel works of Great Britain and other countries.



JOHN FRITZ,
President American Committee.

A. P. Head.

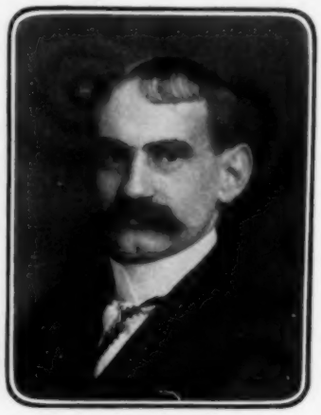
Archibald Potter Head was educated at Clifton College and University College, London. In 1890 he became assistant to his father, Jeremiah Head, consulting engineer, and in 1894 became his partner, moving the office from Middlesborough to London, under the style of Jeremiah Head & Son. Jeremiah Head died in 1899 and in 1904 another son, Benj. W. Head, was taken into partnership, the style of the firm remaining unchanged. Since 1899 A. P. Head has acted as joint managing director of the Otis Steel Co., Ltd., Cleveland, which he has visited fifteen times. He has read papers before the Institute of Civil Engineers, Iron and Steel Institute, Society of Arts, etc., on engineering and metallurgical subjects.

Sir W. T. Lewis.

Sir William Thomas Lewis, baronet, who is a vice president of the Institute, served his apprenticeship at the famous iron works of "Hills Plymouth," in the Welsh home of the iron trade, Merthyr Tydfil, between 1850 and 1855, passing through the pattern shop, fitting shop, foundry and drawing office. Subsequently he was engaged with blast furnaces, mills and collieries of Hills Plymouth. In the early 70's he and others purchased the idle blast furnaces of Francis Crawshay at Treforest, and they were operated successfully for years. Sir Lowthian Bell, Mr. Clark, of Dowlais, and Mr. Martin, of Dowlais, being also connected with the enterprise. Sir William is also engaged in tin plate and other works in South Wales and is chairman of three of the largest steam coal colliery concerns. He originated the Monmouthshire and South Wales Coal Association as also the sliding scale arrangement for the settlement of wages between the employers and workmen in the South Wales collieries. For 18 years he presided over the wage adjustments affecting 100,000 workmen. He is managing director of the Cardiff Railway Co. and controls the operations at Bute Docks, Cardiff, which ship ten million tons of coal a year. He has patented various improvements in colliery and shipping machinery.

In the case of the City of Atlanta against the Chattanooga Foundry & Pipe Co. and the South Pittsburg Pipe Co., wherein the plaintiff sued for $50,000, including $5,000 as a reasonable attorney's fee, for damages the plaintiff is alleged to have sustained by the illegal bids and contracts of the defendants, caused through their association with an unlawful trust styled the Associated Pipe Works, was decided by the jury rendering a verdict in favor of the plaintiff to the sum of $1,500 and $2,500 as the attorney's fee. In accordance with a United States statute, Judge Clark, who presided, tripled the amount of the verdict, making the total recovery $7,000.

The Tennessee Coal, Iron & Railroad Co. has blown in its No. 4 furnace at Bessemer, Ala. No. 3 Bessemer was blown in about two weeks ago and Nos. 5, 1 and 2 will soon be in operation. No. 5 is undergoing repairs. It is expected that one of the Tennessee company's Oxmoor furnaces will be in blast in a few days. The Sloss-Sheffield Steel & Iron Co.'s No. 1 furnace, which is being rebuilt, will be ready for the torch in November. The furnaces operated from Birmingham headquarters now in blast are as follows: Tennessee Co.—Five at Ensley and two at Bessemer. Sloss-Sheffield Co.—One in Birmingham, two in North Birmingham and two in the Sheffield district. Republic Co.—Two at Thomas. Woodward Co.—Two at Woodward. Lacey-Buek.—One at Trussville. The Tutwiler Co.'s Vanderbilt furnace is being repaired, but will be lighted again very soon.



T. W. ROBINSON.
Member Chicago Committee.

This year's strike on the Great Lakes caused the two heaviest iron ore carrying roads of Minnesota to lose $3,500,000 in gross earnings and $2,750,000 in net income, according to the annual reports of the Duluth & Iron Range and the Duluth, Mesabi & Northern for the year ending June 30, 1904. Nevertheless both roads earned net more than 33 1-3 percent on their capital stock.

At the meeting last week of the Colorado Fuel & Iron Co. the old board of directors was elected, with two exceptions. Starr J. Murphy, of Montclair, N. J., and Judge D. C. Beaman, of Denver, were chosen to succeed J. A. Kebler, deceased, and J. C. Osgood, who resigned some time ago.

A petition asking that the Wichita Bridge & Iron Co., Wichita, Kan., be placed in the hands of a receiver, has been filed. Lack of operating capital is the cause of the temporary embarrassment. The company has a plant in Wichita and one in Enid, O. T.

Changes in the American Iron Industry since the Iron and Steel Institute Meeting of 1890.

By B. E. V. LUTY.

When the members of the Iron and Steel Institute visited the United States fourteen years ago they found a state of development in the American iron and steel industry which they had not anticipated. They were treated to a genuine surprise. Not because there have not been startling changes in the industry since then, but rather because these changes have been so well advertised, the visiting members of the Institute this year will find comparatively little cause for wonder. In the exploitation of new sources of raw materials, in tonnage and equipment of plants, and in the employment of steel in new ways the American iron and steel trade has made remarkable progress. It is proposed here to recount briefly the more important changes that have occurred since the last visit of the Institute.

Tonnage Output.

For four years the production of 9,202,703 gross tons in pig iron in 1880 remained a record, but the following decade saw this substantially doubled by the production of 18,009,252 gross tons in 1903. Steel has shown a much greater increase, the total tonnage of Bessemer and open-hearth ingots in 1890 constituting 46 percent of the pig iron production, while in 1903 the proportion had risen to 80 percent. Obviously the greater part of the proportionate increase has been due to the decadence in the manufacture of wrought iron, but not all of it. There has been an appreciable displacement of iron castings by rolled forms. The production of open-hearth ingots rose from 513,232 gross tons in 1890 to 5,837,789 gross tons in 1903, while Bessemer ingots increased from 3,688,871 tons to 8,577,228 tons. Roughly speaking, the production of puddled iron has dropped from 2½ million tons, weighted in the rolled form, to less than a million tons.

The Mesabi Iron Ore Range.

In 1890 the four older iron ranges of the Lake Superior region were well developed, even the newest, the Vermillion and Gobegic, having been substantial producers for the five preceding years, but the Mesabi was wholly unknown as a producer and its future importance scarcely dreamt of by prospectors. In 1903 the four old ranges produced only 26.5 percent more than they did in 1890, while the Mesabi production last year exceeded the combined production of the other four ranges. To the beginning of 1890 the old ranges had shipped 48,293,628 tons. Two of them, the Marquette and Menominee, together shipped 2,000,000 tons a year ten years earlier. In less than ten years following the initial shipments of 4,245 tons in 1892, the Mesabi range had rolled up a greater total than the older ranges had shown in several decades ending with 1889. The following table shows the shipments, in gross tons:

	1890.	1903.	Total through 1903
Marquette.....	2,993,664	3,040,245	69,746,409
Menominee	2,282,237	3,741,284	45,988,855
Vermillion	880,014	1,676,699	20,738,205
Gogebic	2,847,810	2,912,912	40,731,186
Total old range..	9,003,725	11,371,140	177,204,655
Mesabi	.....	12,892,542	66,640,349
Grand total	9,003,725	*24,281,595	†243,865,237

*Including 17,913 tons miscellaneous.

†Including 20,233 tons miscellaneous.

The earlier development of the Mesabi range was of bodies lying close to the surface, whereby with a small stripping expense large quantities of ore could be gained by the steam shovel, and a remarkably low cost of mining resulted, being but a small fraction of the cost of mining even the more accessible deposits of the old range. Of late, however, the attraction of the Mesabi range has not been simply the extremely low cost of mining, as more difficult propositions have been undertaken. The relative low cost of Mesabi mining assumes an alternative in the use of Mesabi and old-range ores; yet the fact that the known reserves of the Mesabi range are three or more times those of the four old ranges combined, together with the fact the old ranges are under much closer ownership by the older steel producers, leaves no alternative, and Mesabi range shipments must more and more preponderate as the years go by.

Blast Furnace Development.

The Mesabi ores, being fine and soft, are distinct from most of those of the four old ranges, and introduce a different element in the smelting operation. In the past few years the necessity of using these ores in increasing quantities has accordingly been the dominant influence in blast furnace development, and has led to an apparent, if not a real, retrogression in the matter of size of stack.

When the members of the Iron and Steel Institute visited the United States in 1890, the largest blast furnaces they saw were Furnaces H and I of the Edgar Thomson group of the Carnegie interests. These furnaces had just been completed during the year, and were each 90 x 22 ft. They have since been altered and are now 91 x 22 and 90 x 20 ft. respectively. In 1896-7 a distinctly new era in blast furnace construction was marked by the completion of the four Duquesne furnaces, originally designed to be 100 x 22 ft., with a capacity of 25,000 cubic feet. The bosh of No. 4 as actually built, however, was one foot smaller, while the bosh of Nos. 2 and 4 has since been enlarged to 23 feet. These furnaces were built with two distinct ends in view: (1) the employment of large percentages of Mesabi ore; (2) a greatly increased output, partly through the increased size of the stock, but also through increased pressure and volume of air. Two were equipped with ten 7-in. tuyeres and two with twenty 5-in. tuyeres.

This new type of furnace was followed by many, but not all, steel works. The Sharon Steel Co. intended building two furnaces 100 x 22 ft., but after blowing in the first, in September, 1901, concluded to follow it with two smaller stacks instead of one large one, and as a result Furnaces 2 and 3 at this plant are now 85 x 19 ft.

While the value of the 600-ton furnace has been open to comparatively slight question, it seems to be well settled that for the production of foundry iron, or perhaps a better expression may be, to meet the requirements of a merchant furnace desiring to produce foundry, Bessemer or basic iron at will, a somewhat smaller stack is preferable. Of this type the following are instances: Toledo, O., furnace, 80 x 20, blown in May 31, 1903; Adrian furnace, Du Bois, Pa., 80 x 19, blown in Aug. 10, 1903; Cleveland furnace, 80 x 20, blown in Aug. 21, 1903, and the two Buffalo & Susquehanna furnaces at Buffalo, N. Y., 80 x 20, completed this year. These are all merchant furnaces, and their smaller size is due to no question of economy with the owners; they are thoroughly modern in equipment, with ample blowing power and excellent facilities for handling the raw materials.

The new furnaces at Buffalo, N. Y., not yet all completed, of the Lackawanna Steel Co. (which, by the way, is now rounding out the largest single iron and steel plant in the world), well illustrate the strong influence of the Mesabi ores. These

furnaces are six feet shorter, yet two feet larger bosh diameter, than the original Duquesne furnaces, the departure being chiefly to secure an increased outward slope of the walls from the top to the bosh, this "batter" being 0.82 in. to the foot with the Lackawanna furnaces. The Clairton furnaces, completed last year, have a "batter" of 0.7 in., and even this exceeds that of earlier large furnaces. The tendency is clearly back to the slopes prevailing with the old hand-filled furnaces, still in operation.

There is still disagreement among the doctors, however, as to the most desirable remedy for the explosions and other difficulties attending the use of very high percentages of Mesabi ores. Until within the past two or three years dependence was placed largely upon explosion doors, but lately a number of furnaces have been built with an absolutely closed top, designed to stand a pressure of 35 pounds per square inch, and the position has been quite ably defended that the explosion doors greatly accentuate the frequency and force of the explosions they were adopted to relieve. Heterogeneous and stratified filling have also been urged, and the former has been shown very successful with hand filled furnaces. Neither is at present possible with automatic filling. The Lackawanna furnaces have a movable oval deflector, from which results are expected.

The Decadence of the Puddling Furnace.

The supplanting of wrought iron by mild steel in the United States seems to have lagged behind the similar movement in England. In the absence of accurate statistics, it is fairly certain that the maximum production of puddled iron in the United States occurred in 1890. The relative percentage had of course been decreasing since the first advent of soft steel. The decline of puddling seems to have proceeded most rapidly in 1892, as a summary of puddling furnaces in the Pittsburg district showed a decline from 1,103 to 828, or 25 percent, during the year. The leading steel makers, like Carnegie, Jones & Laughlins, and others, had retained the puddling furnace only under sufferance while they prosecuted a campaign of education, and about this time Jones & Laughlins finally abandoned it.

Within the past few years some important consumers have declared unequivocally for wrought iron for certain purposes, and the distinctively iron industry will live, even without such favor, since it furnishes a means of utilizing certain grades of scrap which are otherwise of little use.

The Geographical Movement.

The greatly increased importance of the Lake Superior region as a source of iron ore, and the decline of wrought iron to make way for steel have led to interesting geographical movements since 1890. In that year the eastern half of the state of Pennsylvania made substantially as much pig iron as the western half, while there were six blast furnaces on the shore of Lake Erie, five at Cleveland and one at Tonawanda, N. Y., (which may be treated as a lake port). In 1890 the western half of Pennsylvania made one-fourth of the country's total production of 9,000,000 tons; now it is making more than one-third of a total which has doubled. The eastern half of the State has slightly declined in actual tonnage, and now makes only 10 percent of the country's total pig iron production, and less than one-third as much as the western half of the State. The shore of Lake Erie today is dotted at intervals with blast furnaces, and there are now 25 furnaces built or being built, of which 13 are in the Buffalo, N. Y., district, at the extreme eastern end of the lake, and the balance in the State of Ohio.

Alabama, of which such great hopes were entertained in 1890, has largely increased its production, but has barely contributed the same quota to the country's total pig iron production. The state has become a steel maker, and enjoys the distinction both of being the first to make open-hearth steel rails in commercially important proportions, and of using, at least in an experimental way, the pneumatic process as a prelude to the regular basic open-hearth process, to reduce silicon and carbon.

The United States Steel Corporation.

Three and a half years ago the greatest company in the world was formed—the United States Steel Corporation. As of April 1, 1901, this corporation acquired substantially all the stocks of the Carnegie Co., Federal Steel Co., American Steel & Wire Co., National Tube Co., American Tin Plate Co., American Sheet Steel Co., National Steel Co. and American Steel Hoop Co. On the same date an agreement was executed for the acquisition forthwith of the American Bridge Co. and the Lake Superior Consolidated Iron Mines It thus started with a dominating position in the manufacture of pig iron and of Bessemer and open-hearth steel and the principal steel products. A few important steel producers remained on the outside, such as the Lackawanna Steel Co., Jones & Laughlin Steel Co., Pennsylvania Steel Co., Cambria Steel Co., Tennessee Coal, Iron & Railroad Co. and the Colorado Fuel & Iron Co. No attempt was made to control the manufacture of forge and foundry pig iron, crucible steel, or wrought iron.

Although the period elapsing since the Steel Corporation's formation has been in general one of great activity in the American iron trade, resulting in the building or enlarging of many independent plants, the Steel Corporation has almost kept pace with the growth of the American industry as a whole. This has been accomplished partly by the rebuilding and enlarging of its original plants, partly by the erection of wholly new equipment, and partly by purchases.

At its formation, April 1, 1901, the Steel Corporation controlled 74 blast furnaces, with a rated capacity of 9,140,500 gross tons per annum. These furnaces actually produced, in the calendar year 1901, 6,803,988 gross tons of pig iron. In 1903 the corporation produced 7,279,241 tons of pig iron. At the present time it has completed or well advanced towards completion 96 blast furnaces, with a rated capacity of 12,636,000 tons annually.

The corporation started with a steel capacity rated at 7,825,000 gross tons of Bessemer ingots and 2,862,000 gross tons of open-hearth ingots, chiefly by the basic process, making a total of 10,687,000 gross tons annually. The actual production in 1901 was 6,113,588 tons of Bessemer ingots and 2,746,996 tons, a total of 8,860,584 tons. In 1903 the corporation produced 6,191,660 tons of Bessemer and 2,976,300 tons of open-hearth ingots, a total of 9,167,960 tons. Its present rated capacity, not including uncompleted work, is 8,198,000 tons of Bessemer and 3,640,500 tons of open-hearth, a total of 11,838,500 tons.

The capitalization of the Steel Corporation is in keeping with its enormous tonnage. It stands approximately as follows:

First mortgage bonds	$303,917,000
Second mortgage bonds	171,000,000
Preferred stock	360,281,100
Common stock	508,302,500
Total	$1,343,500,600

Something over $6,000,000 of the bonds have been redeemed and are bearing interest for the benefit of sinking funds. There are besides some $112,000,000 of bonds issued by subsidiary companies, which are prior liens on individual properties, and some in addition are guaranteed directly by the Steel Corporation.

The Tin Plate Industry.

A subject which came in for no little discussion and good natured banter on the Institute's last visit to America was the possibility of a tin plate industry being established here. As a result of long and arduous work on the part of the

friends of tin plate, a tariff duty of 2.2 cents per pound had been incorporated in the McKinley law, just passed and put into effect July 1, 1890. The tin plate duty, however, was not to go into effect until July 1 of the following year. There was a disposition on the part of friends of the Welsh tin plate industry to doubt whether the United States could establish a tin plate industry of its own of commercial proportions. This doubt was certainly shared by Congress, as shown by a peculiar provision inserted in the McKinley law, which is not without interest now that the outcome is so well known. This provision was that at the end of six years of the 2.2-cent duty, or on July 1, 1897, tin plate should be wholly free of duty (the previous duty had been 1 cent per pound) unless in any one of the six fiscal years the domestic production should have equalled one-third of the imports in any one of these years. In other words, the year of greatest domestic production was pitted against the year of least imports, and was to equal only one-third such minimum. The provision was made further favorable by excluding from the reckoning of imports such tin plates as should be imported for rebate or re-export purposes, and including in the reckoning of domestic production such fine sheets or black plates as should be stamped and thereafter tinned or terne plated. Apparently such provision was useless, yet it actually gave some concern at the outset. In the third year, however, the provision was more than met. In 1894, the Democratic party having come into power, the duty was reduced to 1.2 cents per pound, but this did not stop the growth of the industry; if anything it encouraged it, since it showed the worst that could reasonably be expected from the enemies of the tariff. In 1897 the duty was increased to 1.5 cents, the Republican party having regained power.

The production of tin plate and terne plate in the United States has been as follows, in gross tons, the production made from imported black plate being included, but since 1894 such production has been entirely negligible:

1891	990	1898	326,915
1892	18,803	1899	360,875
1893	55,182	1900	302,665
1894	74,260	1901	399,291
1895	113,666	1902	366,000*
1896	160,362	1903	400,000†
1897	256,598		

*Close estimate.
†Rough estimate.

The production of the current year, 1904, will likely surpass all previous records.

The increase in production up to and including the year 1897 represents substantially the inroads made upon the import trade. There was no great increase in domestic consumption, since in 1890 and for some years previous our imports had averaged from 300,000 to 325,000 tons, of which from 50,000 to 75,000 tons were required for the "drawback trade," being re-exported as containers, with the duty refunded, representing therefore a domestic consumption of say 250,000 tons annually. It was this trade alone which the domestic industry could hope to capture. Since about Jan. 1, 1898, imports of tin plate for domestic consumption have been negligible, and the increase in domestic production of between 100,000 and 150,000 tons represents an increased consumptive demand, due to the increase in population and an increasing per capita consumption.

Something has been done by the leading American tin plate interest towards capturing from the Welsh makers the "rebate trade" as well. This movement has only been important, and even then not very important, during the past two years. In October, 1902, an arrangement was made with the tonnage men in those of the tin plate mills which are union, whereby they would work at a concession of 25 percent in wages on tin plate intended for the rebate trade. This concession has since been reduced to 12½ percent, and is therefore almost negligible, particularly since the tonnage labor does not, as in Wales, represent the great bulk of the labor cost of a box of tin plate. The men covered by the agreement are only the roller, heater, double, catcher, screwboy and shearman. Their wages are paid per ton, but the following table reduces them to the box, with the rebate at 12½ percent:

	Total.	Rebate.
100-lb. plates	45.76c	5.72c
95-lb. plates	45.16c	5.65c
90-lb. plates	42.79c	5.35c

In the six fiscal years ended with June 30, 1903, the quantity of imported tin plate on which drawback was paid by the government has been 761,764,074 pounds, an average of 126,960,676 pounds per year. The imports in the same period have exceeded this by 93,383,435 pounds, an average of 15,563,906 pounds per year, equal to 6,948 gross tons.

Fourteen years ago the Iron and Steel Institute found no American tin plate industry; this month they find one which for seven years has fully supplied a domestic demand which has increased by one-half.

Few parallels can be found to the improvement in equipment and processes which has marked these comparatively few years in the American tin plate industry. Nor was this unnatural, considering the conditions. A very large profit was vouchsafed to the pioneers, if they could actually succeed in making tin plate at all. Many men who had worked for the imposition of the McKinley tin plate duty shrank from investing their money afterwards, because there was a remarkable change in the political aspect, and their places were taken quite freely by men who had had no previous experience in any branch of iron and steel manufacture. Naturally they made innovations. At this late date the feelings of no one will be hurt by the bald statement, which cannot be controverted, that many of the innovations were made purely through ignorance of the "right" or old way. Nor was it unnatural that in building wholly new plants new departures should be made. In Wales new tin mills were not being built.

In the hot mill, the Welsh practice of two stands of rolls, one roughing and one finishing, was abandoned, and a single stand used for the whole work. Instead of rolls 16 to 18 in. in diameter, as in Wales, rolls 20 to 22 in. in diameter were employed at first, and the size was shortly increased to 24 in., while 26 in. is now the standard. Instead of rolling a "cut and a half," or a 20 x 42 sheet making one 20 x 28 and one 14 x 20, packs were rolled 20 x 56, each sheet making two sheets 20 x 28, and even packs 28 x 60, making three of 20 x 28 have been successfully rolled. Not all of the increased output was due either to skill of equipment; the workmen's organization was more liberal in fixing the tonnage allowance. This is shown by the fact that without changes in equipment or increased skill, the Welsh output has in the past few years been very materially increased.

An early innovation was the general adoption of the squaring shear for squaring and shearing the pack, against the Welsh practice of marking out the pack and using the doubling shear. The roll lathe has been generally employed for turning the rolls, in place of turning them in the housings by a slow motion.

More important innovations were the introduction of large boxes for annealing, with mechanical means for charging them into the furnace and withdrawing them, and the arrangement of cold mills tandem, with conveyors and means for throwing out defective sheets after the second pass.

Of general improvements the most important has certainly been the electric three-motor traveling crane, which performs a variety of very useful functions, and has wholly supplanted the jib cranes and their occasional successors, the pneumatic cranes.

In all this there has been no important departure from

former principles, nor was there in the general adoption of branning and dusting machines in the tinhouse—simply the natural use of machinery in a country where labor is dear. In fundamental processes some changes have, however, been made. The first important one of these is the "Monessen system," employed at the Monessen, Pa., works of the American Tin Plate Co., the invention and patent of W. H. Donner. It is rather a principle than a system, being capable of being worked in a variety of ways. It consists essentially in confining each of the successive operations of roughing, rolling the pairs, rolling the fours, and finishing the eights, to a separate stand of rolls, or grouping these operations, as the roughing on one stand, the pairs on another, and the fours and eights on another, or rather half the product of the first two stands on each of two succeeding stands. Its success, where success was doubtful in the minds of those who adhered to old principles, is due to the fact that the continual changes in the contour of the rolls, working the old style, is due in large part to the fact that they are called upon to do such a variety of work, from roughing short hot bars to finishing long packs of eights at a lower temperature. The rolls are turned right and kept right, rather than being controlled by the skill of the men.

A more radical innovation is the Bray semi-continuous mill, the invention and design of C. W. Bray, chief mechanical engineer of the American Sheet & Tin Plate Co., and installed at the Monongahela works, within the city limits of Pittsburg. Briefly, its operation consists in heating the bars in a continuous heating furnace, roughing them rapidly in a continuous mill of five stands, with tables, automatically matching the bars, rolling them in a continuous mill of two stands, and then automatically doubling them into fours. From this point the old style is followed, with two heatings, two rollings, and a doubling, all by hand. This mill has been found better adapted to the heavier than the lighter gauges, and accordingly the company is now installing a mill on this principle at Sharon for the manufacture of sheets. It will have one more stand in the continuous mill, and is intended to carry the product far enough that it may be finished by hand with but one additional heating.

The Bennett catching device has been in successful use in a number of tinhouses, and performs the function of the "iron man" in Wales, being naturally more in favor on account of the greater saving in labor in the United States. The brush system, first used at Martins Ferry, O., has gained favor as reducing and making more uniform the tin coating. It consists of a fine wire brush pressing on the under side of each of the finishing rolls in the oil, whereby the tin adhering to the finishing rolls is largely removed. By this means the coating has been gotten down to 1.8 pounds per box of 112 sheets, 14 x 20.

Dominion Iron and Steel Meeting.

TORONTO, Canada, Oct. 25.—At the annual meeting of the Dominion Iron & Steel Co., held at Montreal Oct. 19, the report for the year 1903 showed net profits on operations of $115,576. The interest on bonds, dividend, appropriation for shrinkage in values and other items, however, absorbed both profits and credit balance for 1902 and left a deficit of $584,231. A decidedly optimistic tone, however, prevailed in view of the completion of the plant and the favorable prospects for the industry. A supplementary statement by Graham Fraser, director of works, outlined the existing condition of the enterprise. The company will take during the current year about 315,000 tons of ore from its mine on Belle Island, Newfoundland, using about 115,000 in its works at Sydney, N. S., and disposing of 200,000 tons in Europe at good prices. The washing plant has been completed and is washing coal for two blast furnaces. Of ten furnaces of the open hearth plant five are in operation and the others being overhauled. Additional gas producers needed to complete the plant are under construction. The rolling mill is in good condition and of sufficient capacity to roll all the ingots produced by the open hearth furnaces. Material was arriving on the ground for remodeling and enlarging portions of the present heating furnaces.

J. H. Plummer, president, spoke confidently of the future, especially in connection with the manufacture of steel rails and rods, declaring that the rod mill had been pronounced by experts the best ever constructed. He said it is capable of producing all of this material needed in Canada. The native iron ore is of excellent quality and only needs an admixture of 6 percent of foreign ore to produce special foundry pig. The cost of the ore laid down at the works is less than has been estimated and Lake Superior ore has been landed there almost as cheaply as in Pittsburg, while Swedish ore is landed more cheaply than can be done in any American iron centre. Vice President Frederick Nichols said that 18 months ago everything looked as badly as it possibly could, but by the plan under which the directors had put a million and a half dollars into the enterprise they had been enabled to complete their plant and the company is now fairly on its feet. The old directorate was re-elected and at a subsequent meeting of the board Mr. Plummer was again chosen president and Mr. Nichols vice president.

Massicks & Crooke Hot Blast Stoves.

G. W. McClure, Son & Co., engineers and contractors, Bessemer building, Pittsburg, have recently completed four McClure (Massicks & Crooke) fire brick hot blast stoves for the Wheeling Steel & Iron Co., Martins Ferry, O., and have under erection four stoves for the Shenango Furnace Co., at Sharpsville, Pa. In the past seven years this company has erected 103 of its hot blast stoves in this country and Mexico. For the Carnegie Steel Co. 52 were built at its various blast furnace plants, while all the subsidiary companies of the United States Steel Corporation have 60 in use. For the LaBelle Iron Works, Steubenville, O., 8 have been built and the same number for the Republic Iron & Steel Co., at Youngstown and Thomas, Ala. In Mexico four have been built for the Campania Fundidora de Fierro y Acero de Monterey, Monterey, Mexico. The pioneer set of stoves of this type was built seventeen years ago and one or more of them are located at a majority of the furnace plants throughout the country.

The South Baltimore Steel Car & Foundry Co., Baltimore, Md., has received an additional order from the Atlantic Coast Line Railroad Co. for 500 new felt lined ventilated box cars. This makes the order in the company's hands aggregate 100,000 for the Coast line. J. Edward Harvey, vice president of the Steel Car & Foundry Co., has returned from the South and says that the business of the railroads is increasing greatly and that in the near future practically all of them will need more cars to handle the traffic. Mr. Harvey says the company now has orders on hand for cars aggregating in cost about $1,000,000.

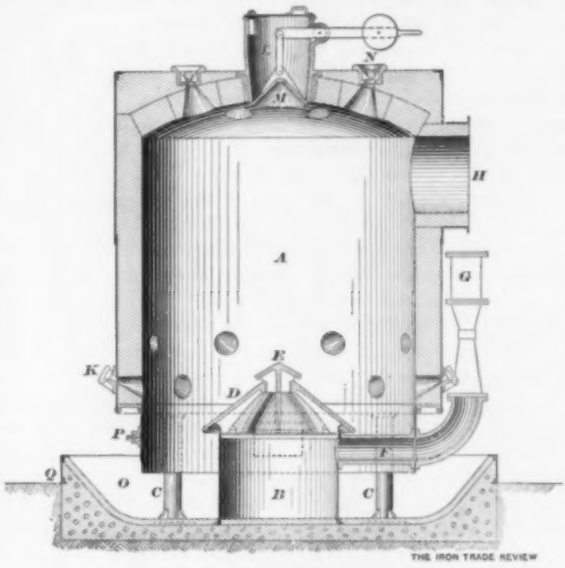
The Acme Flexible Clasp Co., for 17 years located at Clark and Seventeenth streets, Chicago, has leased the Crosby plant and the American Can Co. on Archer avenue, for ten years at a term rental of $59,000. The property has a ground area of 120,000 square ft. and is served by five railroads. Improvements consist of a two-story mill construction machinery building, a blacksmith shop and foundry plant. The last named will be occupied by the James A. Brady Foundry Co. The lessee will make extensive improvements and it is expected will purchase the plant.

The Chicago Writing Machine Co. has moved into its new plant at Galesburg, Ill., and is operating with about 50 employes.

THE AMSLER GAS PRODUCER.

The question of fuel for firing furnaces of all kinds has ever been a vexatious problem. When the use of natural gas is impossible, or unprofitable, the usual recourse is to the use of coal or gas made from coal, and in fact in some cases when the required degree of heat can be obtained only by regeneration, producer gas is especially economical and convenient. The gas producer is a simple piece of apparatus and gas can be generated in any retort that will stand from 1,800 degrees to 2,000 degrees temperature and is provided with an air blast. However, a producer must be operated continuously, sometimes for weeks at a time. It must be built so that coal can be fed and the ash removed continuously without disturbing the output of gas. Clinkers will form and they are troublesome, and in cases when the ash is easily fusible, the clinkers are particularly troublesome.

The illustration shows a producer constructed to meet these requirements. The gas producer chamber A is made of a



AMSLER GAS PRODUCER.

fire brick lined and domed steel shell, supported on the four columns C. The coal is fed into the producer through the covered hopper L and bell M, and the ashes are removed through the water seal in the pan O. This seal is effected by filling the pan O with water. The apron at the bottom of the producer shell then dips several inches into the water and prevents the escape of gas or air through the ashes.

The air is distributed under and through the incandescent fuel bed by the double hood D and E. These are supported on the steel stand pipe B. The air is blown into this standpipe through the pipe F by the special multiple nozzle blower G. There are 16 poker holes K distributed around the sides, and six on top.

This is a water sealed gas producer designed to combine high efficiency, accessibility, and low cost of installation and repairs. No grates enter into the construction, neither are any false bars nor fire cleaning doors required. There is no chance for the air to pass up the side of the producer and burn the gas above the fuel. The air distributor thoroughly introduces the air throughout the bed of ashes below the fuel so that the fuel is completely consumed. When the ashes are taken out they are cooled to almost atmospheric temperature. All these items contribute to large gasifying capacity for the bosh area.

One large blower is used because it requires less steam for the same quantity of air blown into the producer than do a number of smaller ones. By introducing the air through the pipe F above the water, it is impossible for the condensed steam to collect and trap off the air supply.

The loss by radiation is reduced to a minimum as the circular cross section presents the minimum surface for a given volume of fire. The top is made of a brick dome which also reduces the loss by radiation and makes the gas house more comfortable. Aside from the six poke holes in the crown of the producer, there are 16 additional poke holes staggered around the side of the producer. These are used as sight holes to keep the fuel bed even as well as to dislodge and break up clinkers, and are useful to prevent holes forming in fuel bed. They are of convenient height to be accessible from the floor.

There are in addition to the above mentioned poke holes four doors in the ash apron for the removal of large clinkers which may prove troublesome to remove through the water seal, and for access to producer for repairs or other reasons.

As the ash pan is circular in shape, it allows the ashes to be removed from any side of the producer so that there is no trouble in keeping the fuel bed level and the depth of the fire the same throughout the producer. One man can clean a large number of producers.

The producer is of simple construction. The sides of the producer are straight all the way down to the ashes and the poker bars cannot strike any projections on the side of the brick work and the removal of clinkers is convenient. This producer is made by the Amsler Engineering Co. of Pittsburg.

New Vessels for Steel Corporation Fleet.

The Pittsburg Steamship Co., which is the lake department of the United States Steel Corporation, on Aug. 20 placed contracts for four steamers with the American Shipbuilding Co. The new boats will be of the same size and will be nine feet longer than the Augustus B. Wolvin, now the largest freighter on the lakes. They will cost $430,000 each, which will mean an expenditure of $1,720,000. They will be 569 ft. over all, 549 ft. keel, 56 ft. beam and 31 ft. deep. They will be built on what is known as the 12-ft. center hatch, arch semi-straight incline hopper construction, with 34 hatches and no bulkheads in the hold. They will have a capacity of 8,500 tons water ballast, which will enable them to run in any kind of weather in water ballast trim. They will have a carrying capacity of 10,000 gross tons on a mean draft of 19 ft. According to the contracts, the four steamers will be delivered between May 1 and July 1, 1905. President Coulby estimates that the four steamers will carry 800,000 tons of ore in a full season. The Steel Corporation fleet now is able to carry about 1,500,000 per month. These contracts give the American Shipbuilding Co. 14 large vessels to build this winter. All the berths of the company will be full. The vessels will require about 40,000 of shapes and plates.

Taylor & Co., proprietors of one of the largest iron foundries in Greater New York, have moved from their old plant at Driggs avenue and North Twelfth street to their new place at Morgan avenue, near Norman, Greenpoint. The change was celebrated by the employes, who converted the day into one of festivities. After forming in a body in the old shop they paraded to the new place, which they christened by casting four immense iron plates. Zachariah Taylor, the senior member of the firm, was presented with two beautiful floral pieces. The large cast iron plates will be used for flooring around the cupola. The new building is 100 x 200 ft. and 50 ft. high.

Minnesota has been awarded the grand prize for collective mining exhibit at the St. Louis exposition. It carries with it two gold and four silver medals.

The Iron and Steel Institute's American Visit of 1890.

It is a noteworthy fact that two of the principal participants in the formalities attending the opening of the New York meeting of 1904 had similar roles in connection with the New York meeting of 1890. When the Iron and Steel Institute visited the United States 14 years ago, Sir James Kitson, then its president, responded to the address of welcome given by Andrew Carnegie on behalf of the American committee. On last Monday night Mr. Carnegie, as president, responded to the American address of welcome, and Sir James Kitson made the address accompanying the presentation to Mr. Carnegie of the Bessemer medal.

The American visit of 1890 had long been under consideration. As far back as 1873, when the Institute was at Liege for the autumn meeting in Belgium, Dr. Raymond, secretary of the American Institute of Mining Engineers, gave an invitation for an American visit, and this was renewed several times subsequently. In 1889 the invitation was finally accepted, and in September, 1890, the president and Council, together with 295 members of the Iron and Steel Institute and 142 members of the Verein Deutscher Eisenhüttenleute crossed the Atlantic to attend the annual autumnal meeting in New York. This expedition was the most remarkable the Institute had made, and indeed has not been paralleled up to this time. In the extent of territory visited and the number of miles of travel covered, as well as the number of mines and works visited, it remains the most important trip ever accomplished by such an organization. The reception committee was presided over by Hon. Abram S. Hewitt, president of the American Institute of Mining Engineers, and Chas. Kirchhoff was secretary. Special palace car trains conveyed the large party, which with ladies numbered over 500 persons, from city to city, and local committees made provision for the visitors and guided their movements. A special reception was given by President Harrison at Washington. At Pittsburg an international meeting of American, German and English iron and steel experts was held. At the annual dinner in New York Gen. Sherman was a leading speaker and was given an ovation.

There were in reality two expeditions. The party remained together after leaving New York for the visits to Philadelphia, Lebanon, Johnstown, Pittsburg and Chicago. From Chicago one party went south, proceeding direct to Birmingham, Ala., and later visiting various points in Tennessee, Kentucky and Virginia. The northern party went into the Lake Superior region. The southern expedition made a journey of 4,300 miles in all, and the northern expedition one of 4,000 miles—all without a single mishap.

A special volume of over 500 pages was published by the Institute, relating entirely to the American trip and made up largely of an exhaustive discussion by Sir Lowthian Bell, of the American iron trade and its progress during the 16 years preceding the trip. Sir Lowthian discussed the questions of international trade; relative costs of necessaries of life in Belgium, Germany, Great Britain and the United States; costs of assembling materials for the manufacture of iron; iron ore and coal fields on the United States; cost of manufacturing coke; methods of pig iron and steel manufacture in the United States, with a separate chapter on the southern district. The book was a valuable and comprehensive commentary on iron manufacture in the United States and on the various factors in the problem of international competition. It was almost encyclopedic in its extent, and its fullness of data showed at the same time how free the American manufacturers had been in throwing open their works for inspection and furnishing data as to costs and methods, and how incisive and thorough-going were the investigations of the leading minds among the visiting party.

It is noteworthy that this volume, edited by Sir Lowthian Bell, brought together more data concerning iron-making in the United States than had ever been compiled in any single work in this country. It is a remarkable parallel in this respect to the volume brought out in 1902, containing the results of the visit of the British Commission to the United States in the preceding year for the purpose of reporting on American iron trade conditions to the British Iron Trade Association. The iron manufacturers of the United States have thus been put under a double obligation to the British iron trade for these signal pieces of literature.

Sir Lowthian was, as may be supposed, no friend of the American protective tariff, and evidences of his feeling on this subject are frequent in the book he produced. In his conclusion he says that two questions were often discussed among members of the Iron and Steel Institute while inspecting the iron works of the United States. These related to (1) the ability of the United States to furnish all the metal required for home consumption, and, having reached this point (2) the probability of being in a position to undersell British manufacturers in the markets of the world. Sir Lowthian concluded that the United States possessed within itself the power of keeping out all foreign iron without the aid of any duty, and therefore bore down with some severity on the height of the tariff wall that had been built up. He said in this connection: "It is my belief that the effect of this impost has been to raise the cost of iron by the artificial increase of the value of the commodity, so that in point of fact American iron up to this date has been a less formidable competitor for English iron to meet on American soil with the duty than it would have been without it." One is inclined to believe that the history of iron making in the United States in the last ten years has led to some modification, at least, of this opinion of the Nestor of British blast furnacemen.

Concerning exports from the United States Sir Lowthian said: "With regard to an export trade in iron from the United States, I think it very improbable that beginning with pig iron at 53s. per ton at Pittsburg, and adding 8s. 4d. for carriage to a seaport, the older seats of the American iron trade can compete with Great Britain, except to countries close at hand, such as Canada and the northern portions of South America. If we are to meet American iron in Europe, Asia or Australia, it will be that produced in the Southern States of the Union. A railway journey of 200 to 250 miles will bring the produce of Birmingham to Mobile or Pensacola in the gulf of Florida, and the town of Tuscaloosa is only 300 miles from the Atlantic." In this opinion Sir Lowthian came closer to the later developments in the American iron trade than in some others expressed in his work.

In his closing paragraph he says: "I am fully aware that some of the views I have expressed will be opposed to those entertained by many of my American friends. It has been my earnest desire not to express them in such terms as to endanger the cordial relations between us—relations which have been a source both of pride and happiness to me." In this last sentence the distinguished writer gives expression to the spirit that has animated British and American iron manufacturers in their relations of the past decade, and that inspired the invitation on which the present visit is being made.

The Rockford Bolt Works Co., Rockford, Ill., has announced that it will go into voluntary liquidation. The plan of liquidation has been accepted by the creditors. A new company may be organized to carry on the business.

Stockholders of the City Foundry, of Lorain, O., have filed a petition asking that the company be declared insolvent. The company was organized in June, 1903.

A Typical "Independent" Steel Plant, as Illustrating the Chance of the Smaller Producer.

BY VICTOR BEUTNER.

Next to great natural resources, no factor has contributed more to the unparalleled development of iron and steel making in the United States during the last twenty years than the early recognition of specialization as the predominating economic principle of modern times. This was accomplished by a greater and greater restriction of the range of products manufactured in one plant, and the limited field left was exploited to the utmost in a commercial and engineering way, resulting in what is termed the modern steel plant. The rail mill at Braddock, the billet mill at Lorain, the sheet-bar mill at Youngstown and the rod mills at Duquesne are a few significant instances. But one type of product, often with a small range of sizes, is manufactured; but the equipment, highly specialized for the purpose, produces enormous quantities, and labor and fuel-saving devices installed regardless of expense reduce the cost of manufacture per ton to a minimum. Since the production of a marketable material from the ore involves many intermediate operations, the large finishing plants provided for their own raw material simultaneously with the development of specialization in each case.

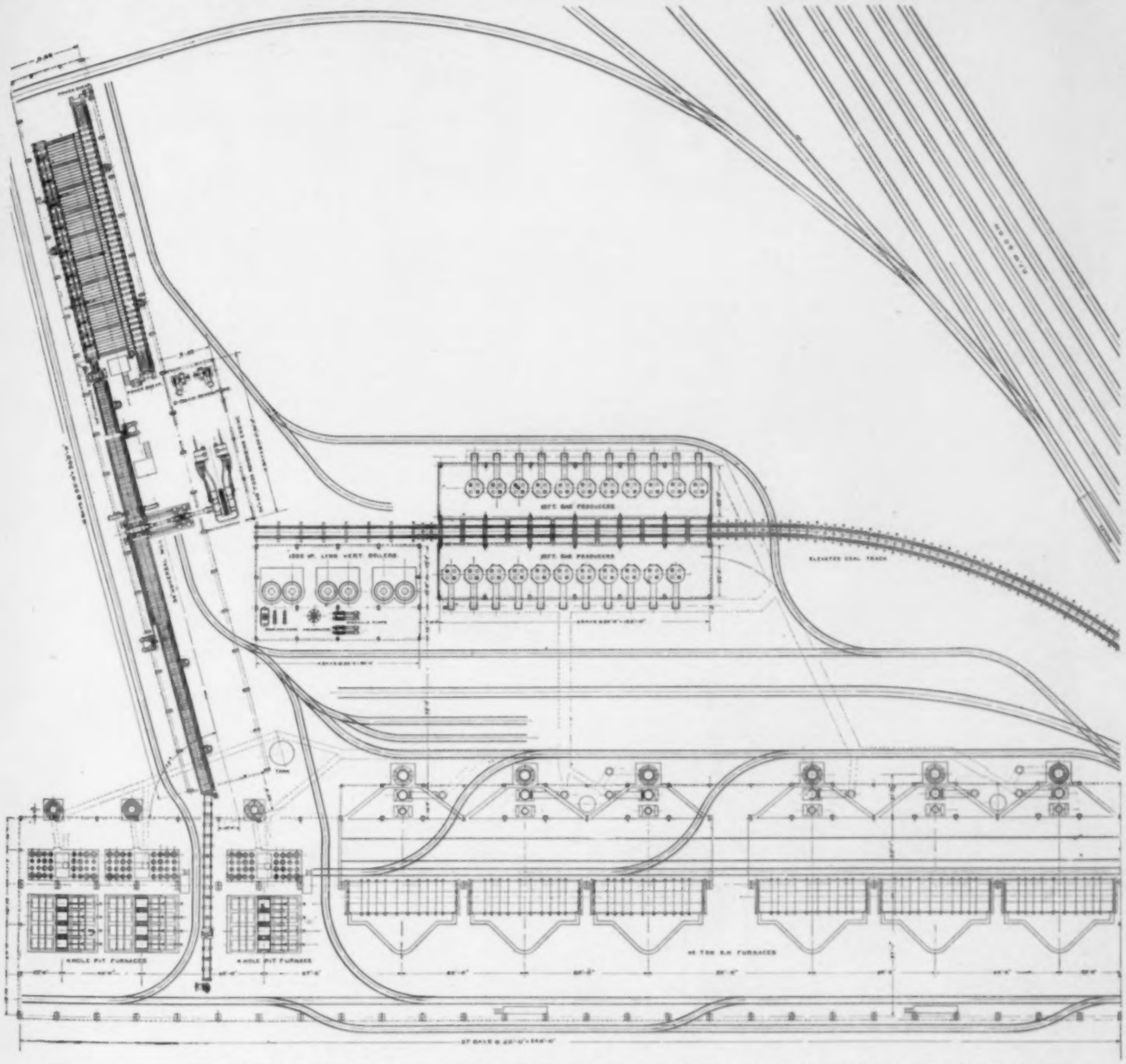


FIG. I.—PLAN OF UNITED STEEL CO.'S WORKS AT CANTON, O., WITH PROPOSED DUPLICATE LAY-OUT OF FURNACES AND GAS PRODUCERS.

Thus several years before the large mergers were effected, and indeed from tendencies quite foreign to the so-called trust idea, a great number of powerful concerns controlled each successive step, from the ore mines and ore transportation, coal mines and coke ovens to the blast furnace; from the blast furnace to the steel plant and the billet, plate or bar

mill, and thence to the numerous mills producing sheets, rods, pipe, merchant bars or wire. The formation of the first set of combinations and the merging of these underlying companies into the Steel Corporation further elaborated these fundamental ideas.

Great industrial movements on economic lines might injure certain individuals and classes and again benefit others, but must be welcome to the country at large. A greater production of a commodity is a benefit to civilization, and if this increase of production is connected with a decrease of cost per unit, the commonwealth is bound to reap substantial gains. The history and scope of the billion-dollar corporation are familiar. Only a few independent concerns, those which neither buy from nor sell to the corporation, were left outside the merger. These were either protected by their location or were controlled by elements friendly to the trust, yet deeming it wise to guard their large interests against possible complications in the future. Several new "independent" enterprises were started and absorbed by the corporation.

Position of the Independent Producer.

These are in few words the developments in our iron industry which have led up to the conditions which today confront the independent manufacturer of a small line of finished products, and which have confronted him for the last two or three years. Let us see if his position is as desperate as it appears at first glance to the observer, who beholds the enormous money power and natural resources, the splendidly equipped plants and the wonderful talent, executive, engineering and commercial, at the disposal of the Steel Corporation.

It must not be overlooked for a moment that the most powerful combination of allied interests for mutual protection and cheapening of production is not in itself a monopoly. Against the greatest dangers of large combinations—stock

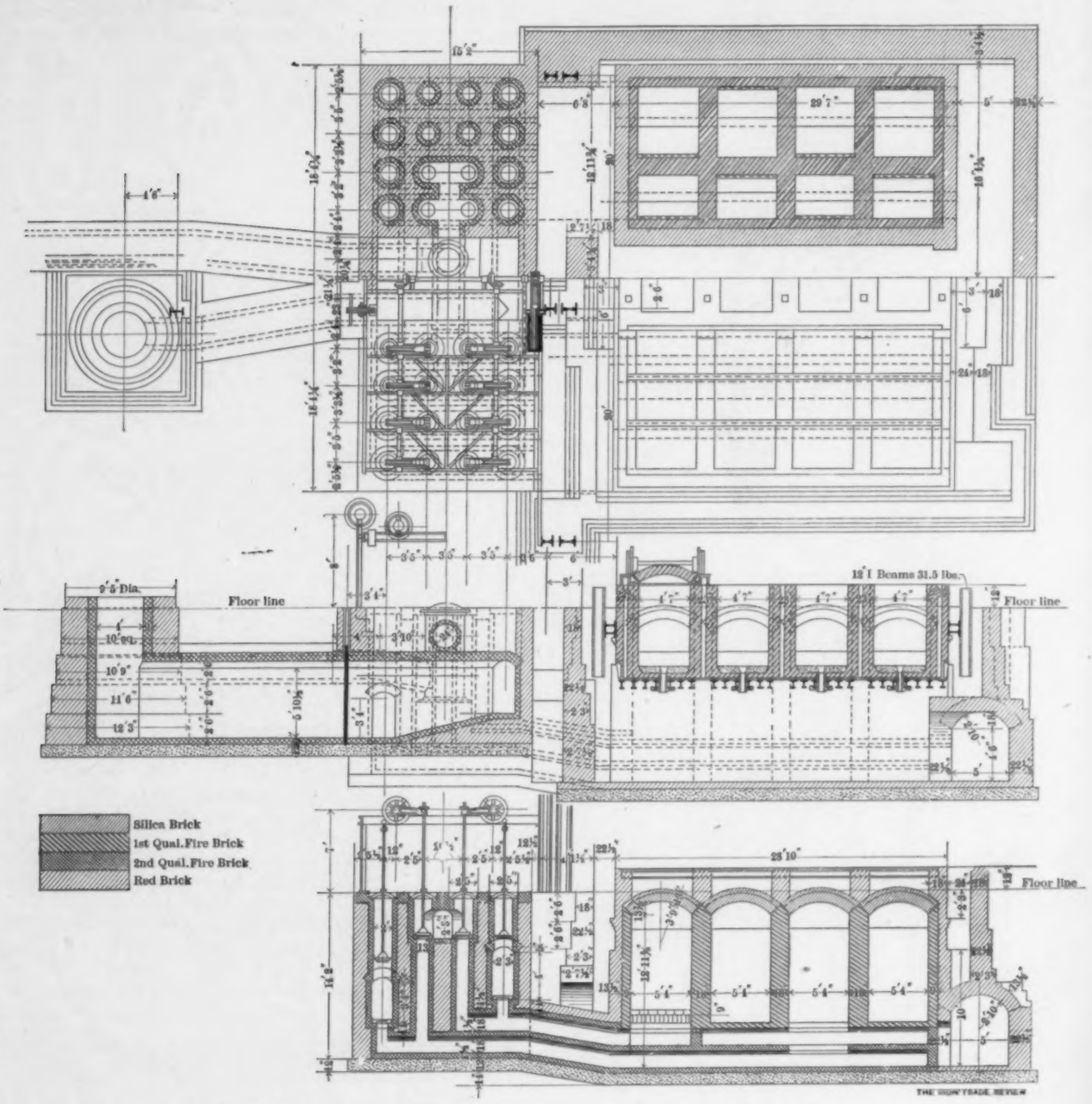


FIG. 2.—PLAN AND SECTIONAL VIEWS OF PIT FURNACES FOR OPEN-HEARTH PLANT.

speculations and the illegal influence of money—the common sense of the people and the law of the land ought to safeguard us, although some of us can testify from personal experience that oftentimes neither is effective. A combination can only become a monopoly if it owns the natural deposits of raw materials to the exclusion of its competitors, or if it controls certain methods of manufacture protected either by secrecy or patent letters. If neither preventive exists an artificial advance in prices will at once cause competition to venture into the tempting field.

Many patents of more or less value and many tricks of the trade exist in the manufacture of iron and steel, but none of a sort to prevent competition. The corporation owns probably the best coking coal deposits and some very choice and large ore properties, but the discovery of new coal fields both adjacent to the Connellsville field and in West Virginia, and the great quantities of ore in sight in independent mines, and a half, however, has cut this artificial price nearly in two. The corporation has been a large purchaser of pig iron, and blast furnace capacity, and the numerous independent furnaces will be forced in the future to sell at truly competitive prices, governed by the old rule of supply and demand, which invariably develops a condition of live and let live. The corporation's undeniable superiority over its small competitor lies in its steel plants, and above all in those large mills. which in direct connection with the actual steel-making department convert the ingot into products which can either be marketed to the consumer, as rails or plate, or which furnish the material used in finishing mills—such as billets, slabs, bars or skelp. These are the plants I have referred to, in which specialization of product and equipment has been carried to perfection. Practically all of them, and a goodly number at that, are controlled by the Steel Corporation, and the great cost of such an installation and the great difficulty of

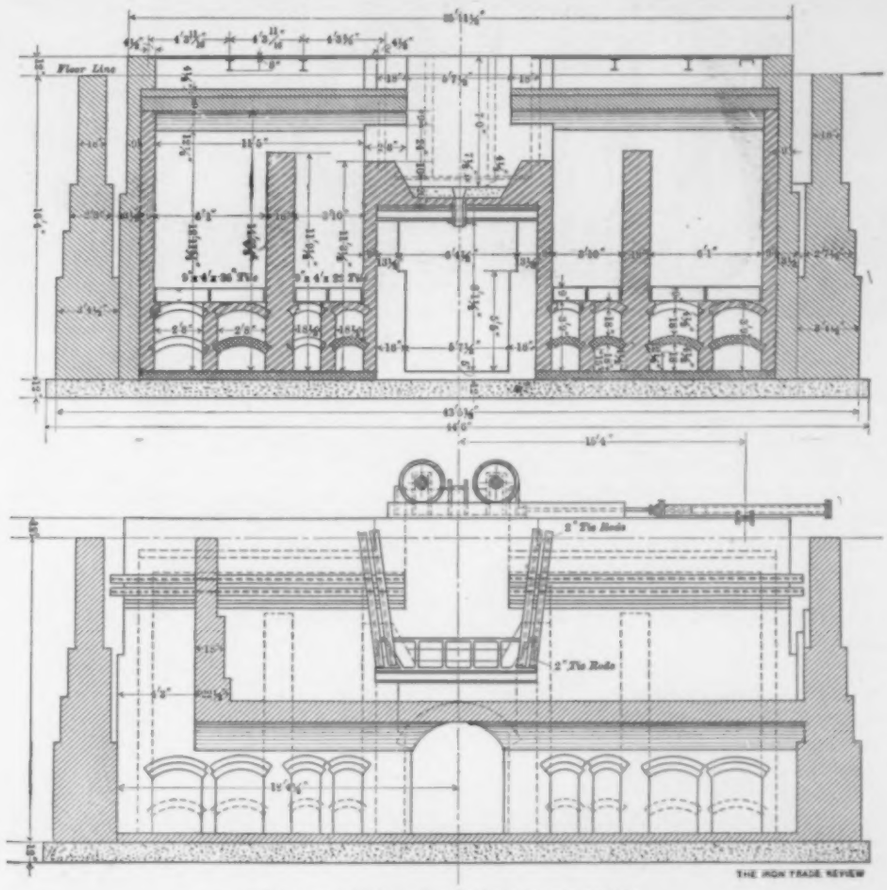


FIG. 3.—SECTIONS THROUGH PIT FURNACES.

with the probably far greater quantities yet undiscovered, make any claims of monopoly in these materials untenable. Therefore if the small manufacturer is seriously threatened, it must be owing to the improved methods in use in the plants of his big rival.

No Monopoly in Ore or Pig Iron.

The methods of mining, loading and transporting ore have certainly developed to a marvelous efficiency. But these are by no means sole properties of the trust. They are employed by every one of its powerful competitors. Ore can be had, and could be had even at the highest tide of iron prosperity from independent mining companies at reasonable prices. The corporation is still a large purchaser of pig iron, and maintained this commodity for several years at a very high level, by placing orders for very large lots at prices, bona fide or not, which established the market rate. The last year finding a market for the enormous tonnage of only a limited type of intermediate product furnish an efficient protection against dangerous competition.

Small Profits in Finished Products.

On the other hand it was impossible to prevent the building of new finishing mills, which usually have a comparatively small economical unit, permitting a ready disposal of the product in the retail market and requiring both for building and operating a capital which must appear insignificant compared with the sums expended in steel plants. The demands of a growing trade can be readily met by adding units to the first installations. Ten sheet mills are, with but slight changes, only a multiple of one mill, and unless the range of sizes is too large, one lap weld pipe mill will turn out one-half of the production of two with the same economy. Of course a modern continuous sheet-bar mill could not be cut

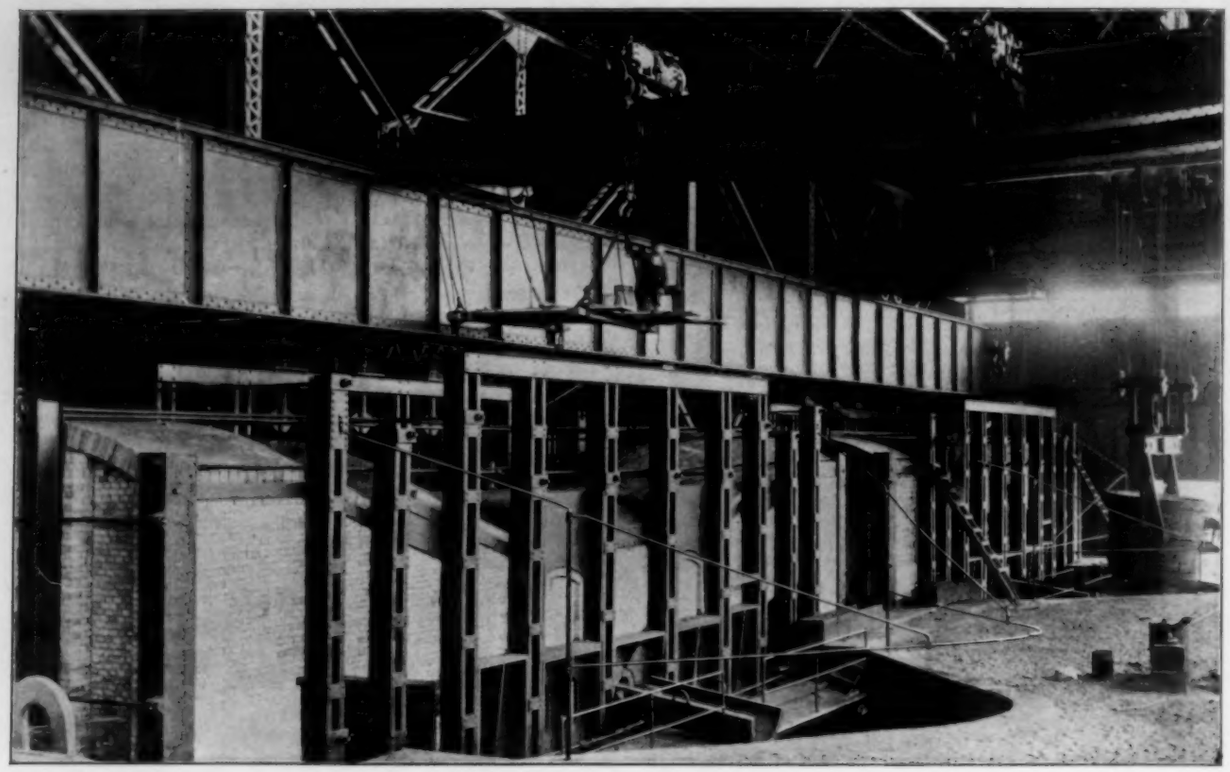


FIG. 4.—POURING SIDE OF 40-TON OPEN-HEARTH FURNACES.

in half and if its output should not be sufficient to supply the demand, the addition of a new economical unit would increase this output at once about 1,000 tons per day. That the steel trust was not slow to recognize these conditions is at once apparent by the prices quoted on intermediate material and finished product, allowing a "spread" which in many cases little more than covers the cost of the additional operation. Add to this the uncertainty of obtaining material from the corporation in small quantities and promptly in prosperous times, when naturally its own finishing plants get the preference, and it is not surprising that the independent manufacturer put all his hopes in his ability to build and to operate his own steel plant in successful competition with the monster plants of the trusts.

United Steel Co.'s Requirements.

Such were the considerations which induced the management of the Stark Rolling Mill operated by the Berger Mfg. Co. and the Carnahan Tin Plate Co., allied interests at Canton, O., to decide in 1902 to erect an independent steel plant. The writer was commissioned to execute plans for a plant which while moderate in investment and in tonnage should yet hold the cost of production at a point which would allow competition with its mighty neighbor.

The limitations were few but sweeping. The mill was to produce about 120 tons of sheet and tin bars daily to supply the two concerns named above. If the production of this small tonnage was not economical, the additional material produced to make up an economical tonnage was to allow the greatest latitude to facilitate the marketing. The new company—called the United Steel Co.—owned an irregularly shaped piece of land closely adjoining the other plants, fronting 600 feet on the main line of the P. Ft. W. & C. railroad

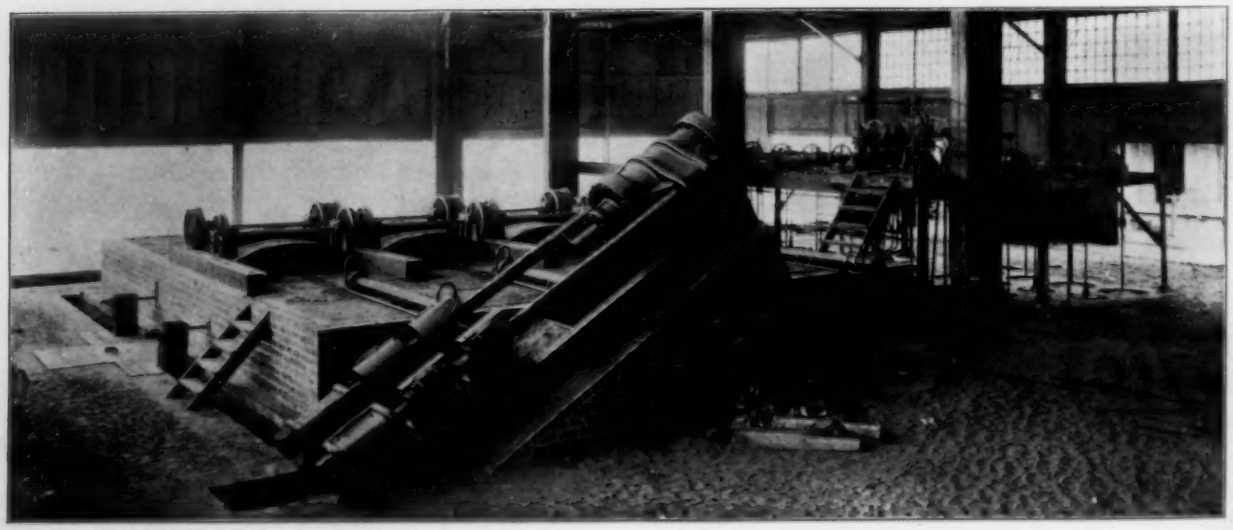


FIG. 5.—PIT FURNACE AND INGOT STRIPPER. VALVE RIGGING FOR PIT FURNACES ON THE RIGHT.

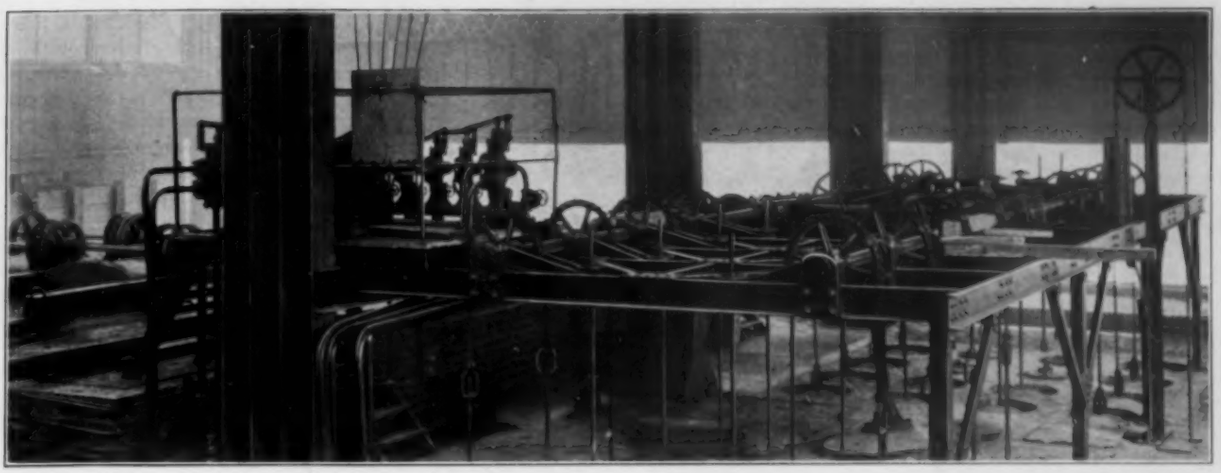


FIG. 6.—VALVE RIGGING FOR PIT FURNACES.

and containing little more than five acres. More could not be obtained without going into expensive purchases, although the company held a suitable tract of land in the immediate vicinity, intending to erect a blast furnace plant in the near future, if this first venture should prove successful. The plant was to be built as economically as possible, neither the first cost nor the expense of operation to be excessive, but a happy medium was to be found. Provisions were to be made for an increase of tonnage.

Here were conditions which practically confronted every independent sheet or tin plate manufacturer. After due deliberation it appeared that an open-hearth steel plant of medium sized furnaces and a universal plate mill seemed to offer the most promising solution of the problem. Before discussing the merits of this equipment a short description of the plant might be interesting.

The general layout as shown in Fig. 1 represents the scope of the plant in its ultimate completion. At present the equipment comprises two open-hearth furnaces in operation and the third practically completed, one pit furnace, one-half of the producers, and 260 feet of the open-hearth building, allowing for future extensions as shown. The mill with all its accessories—engines, tables, shears, boilers, etc., was erected complete. The triangular space between the mill building and the property line is occupied by a steep hill, the excavations of which would have added greatly to the first cost. Room was left outside of the open-hearth building for mold tracks and the space between open-hearth and producers is to be utilized as a metal yard, to be spanned by a light electric traveling crane as soon as found necessary.

Features of the Open-Hearth Plant.

Forty-ton open-hearth furnaces were decided upon as offering satisfactory economy of operation, without calling for an auxiliary equipment of ladles, cranes and crane runways, which would be disproportionately large in comparison with the total steel production and consequently unreasonably expensive. The greater facilities for obtaining scrap in what seemed a promising scrap district, made a basic lining of the furnaces appear preferable, although the better qualities of the acid steel for tin and sheet bars were given due consideration. The limited yard room did not offer a possibility of an approach to an elevated charging platform. This necessitated a depressed pouring pit and checker chambers situated below floor level. Due care was taken, however, to ascertain the level of the ground water, the ground being of gravel and very porous. The water was allowed to find its natural level at the bottom of the excavations, which were left standing open for two weeks of wet spring weather. Concrete was filled in one foot above this level and the chambers erected thereon. The whole furnace installation including flues, etc., was built by the company's force of bricklayers, under supervision of the writer and from detail drawings furnished by

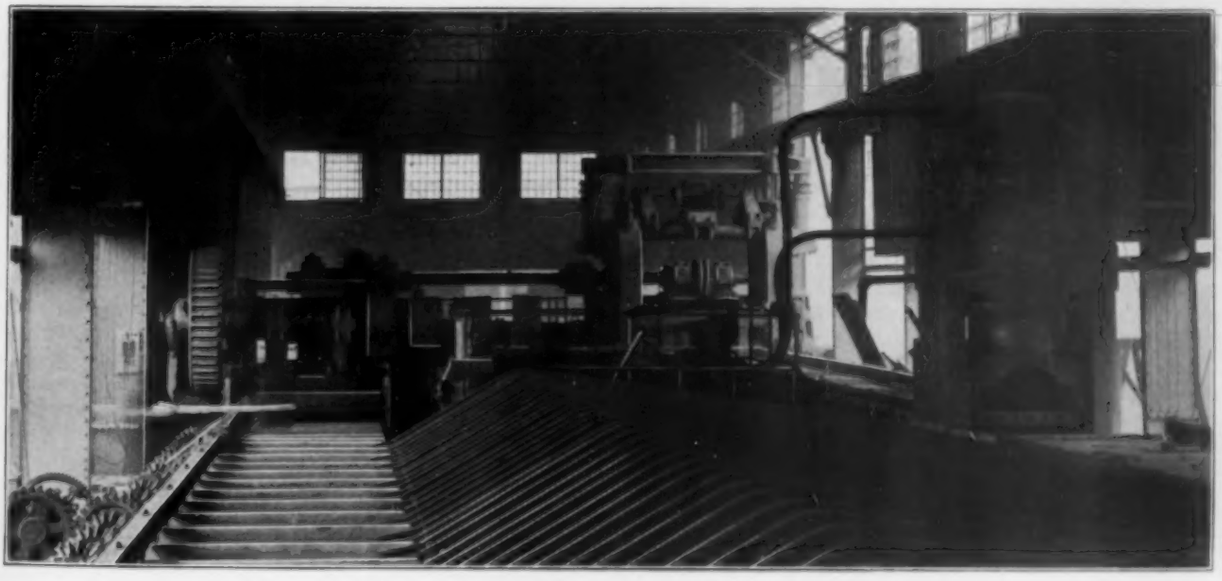


FIG. 7.—HYDRAULIC SHEAR AND STRAIGHTENING BEDS.

him. The general dimensions can be readily recognized from Fig. 2. While designed for an output of 40 tons the furnaces in actual service have produced 10 percent above their rating. The well known principles of modern furnace construction were employed. The furnace proper is held by a permanent structural frame carrying the brickwork on heavy chill plates supported by a grill work of beams. Should a heat ever go through the bottom, it would run into the ladle pit without injury to the chambers. The plan of the furnace and ports shows a plain rectangular shape without off-sets or projections. The system of binders and buckstaves is consequently extremely simple and strong. The roof is comparatively high, slip joints being used where it meets the arches above the ports. The skew back is carried on channels riveted to the the frame, thus allowing repairs of the walls to be made without distorting the roof. The doors are operated by hydraulic cylinders controlled from a pulpit. Ample slag pockets below the port flues prevent overboiling slag from entering the checkers and can be cleaned from the ladle pit by removing the false arches. False arches are also conveniently located at the ends of the furnaces and the chambers for control of the ports and the resetting of the checkers. Forty-two inch Forter water seal valves control the flow of both the air and the gas and are operated by hydraulic cylinders. The self-supporting stack is 120 feet high and has a clear section of 4 feet 9 inches in diameter. Extra cut-off valves and burn-out flues are located as shown on cut.

The furnace proper and the upper half of the chambers is built of Mount Union silica brick, while the brick for the lower parts is Sandy Ridge steel, minor grade brick being used for valve seats and stack lining. The magnesite lining of the hearth extends well into the ports and great care has been taken to place a neutral layer of chrome brick wherever the basic lining joins the silica brick work. At present magnesite is used for making the hearth, although plans are ready for a calcining plant.

Open-Hearth Building.

The open-hearth building consists of a main aisle of 66-foot span, and 35 feet to the roof chord, a 32-foot lean-to and a 16-foot shed. The main aisle is commanded by a 60-ton ladle crane with 15-ton auxiliary hoist built by the Morgan Engineering Co. The furnaces are situated in the main aisle as shown, the crane being carried over them on box girders of 60-foot span and 7-foot depth. The roof system between columns is carried by a Queen's truss 16 feet deep, the lean-to roof trusses being developed as lateral braces. The situation of the furnaces under the main truss makes it possible to use transfer process or direct metal, should either ever become desirable. Under the lean-to the chambers and charging platform are located. From here the furnaces are served by a low-type Wellman charging machine. The charges are made up in boxes in the usual way and the buggies brought in front of the furnace by a narrow-gauge locomotive. The 16-foot shed covers the valve space.

Top-cast ingots are poured from a platform in molds on cars and transferred to the pit furnace located in the same building, and served by a 10-ton electric traveling crane. A hydraulic stripper of the horizontal type is provided for exceptional cases.

Pit Furnace Gas Valve System.

The pit furnace is of the usual construction, with 4 pits

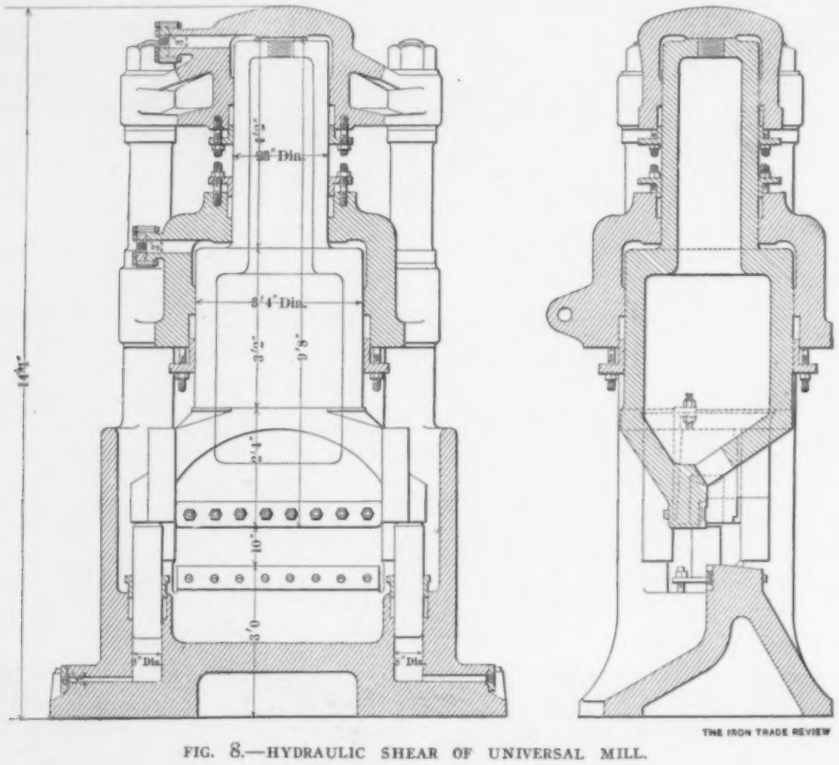


FIG. 8.—HYDRAULIC SHEAR OF UNIVERSAL MILL.

5 feet 7 inches x 4 feet 7 inches, with regenerators for both gas and air, and cinder pockets underneath. The valve system probably deserves special description. Each pit has four mushroom valves at each side, or 32 for the whole system, arranged in four parallel rows. The two outer rows lead into the stack flue, while one of the inner rows is connected with the gas and the other with the air supply. The chains holding the stack valves are attached to sprocket wheels, while the corresponding air or gas valves are suspended from levers, hinged loosely to the same shaft to which the sprocket wheels are keyed. A hydraulic cylinder revolves these shafts by means of bevel gears simultaneously, but the right system in opposite direction from the left. The mode of operation is as follows:

On one side—the one which was so far connected with the stack—the sprocket wheels unwind the chains, allowing the stack valves to seat themselves by making about three-fourths of a turn. After this has taken place, a lug properly placed on the sprocket wheels grips and lifts the lever from which

the respective air or gas valve is suspended and opens it. The chain of these valves is connected with a threaded stem, which passes through a handwheel. This contrivance allows a precise independent regulation of the air and gas supply for each pit, but after the valves are once set the furnace can be reversed at libitum, without disturbing this regulation. On the other side of the furnace, the shafts revolve in opposite direction, the lugs release the air and gas valves and close them before the stack valves are opened. The travel of these latter is considerable and they are lifted into vertical pockets out of the reach of the flame. As a safety an independent main gas valve and main stack damper are provided.

The gas for the open-hearth and pit furnaces is supplied by eleven water seal gas producers of the Swindell type, of approximately 12 feet height by 10 feet outside diameter, provided with patent hoppers, blowers, etc., and capable of gasifying 10 tons of good coal in 24 hours. The flues are extraordinarily large and can act as storage to take care of small irregularities. The stoking platform is about 4 feet above floor level and the coal is dumped from an elevated track 7 feet above the top of the producers. At present the cinder is wanted for filling in, but an ash conveyor is provided for, to load the surplus into cars.

A rope-driven buggy transfers the ingot from the soaking pits to the mill building and deposits it automatically upon the roller table, whence it travels into the mill. The mill itself and 90 feet of heavy blooming tables were built by the Canton Roll & Machine Co., and all auxiliary machinery, shears, transfers and runout tables, etc., were built by the West Penn Foundry & Machine Co., both from designs furnished by the writer. While avoiding elaborate and costly devices, no attempt was made to save money at the expense of quality, and the best material and workmanship, with generous proportions, were insisted on wherever there was a chance of reducing later repair bills.

The Universal Mill.

The mill is of the type known as a universal plate mill. It has 30-inch horizontal and 17-inch steel forged vertical rolls. The maximum opening between the verticals is 49 inches and the minimum is 13½ inches. The horizontals allow a maximum opening of 15 inches. The lead spindle is made in two pieces with three joints. This construction allows it to fall apart in cases of breaks and prevents serious damage to the engines. The pinions are of 34-inch pitch diameter and have 36-inch face with staggered teeth. Through a pinion of the same diameter but one-half face, the power is transmitted to the two driving shafts of the vertical systems. The two caps of the pinion housings cast in one piece carry the bearings for the last three gears, and as evidenced by the drawing, under this construction each pinion can be independently aligned in its relation to the others. The merits of the hydraulic top-balancing rig, both for carrying and changing rolls, led to arrangements for the use of it with Mackintosh, Hemphill & Co., who are the owners of this patented feature. An entirely novel idea was introduced to facilitate the changing of the vertical rolls. In many of the former designs for mills of this type it is practically necessary to dismantle the mill in order to take out the vertical rolls. Attempts have been made to carry the driving shaft in open bearings in the roll housings. This shaft is lifted out and the rolls slipped vertically through the rest bars. But even if the driving cone is made

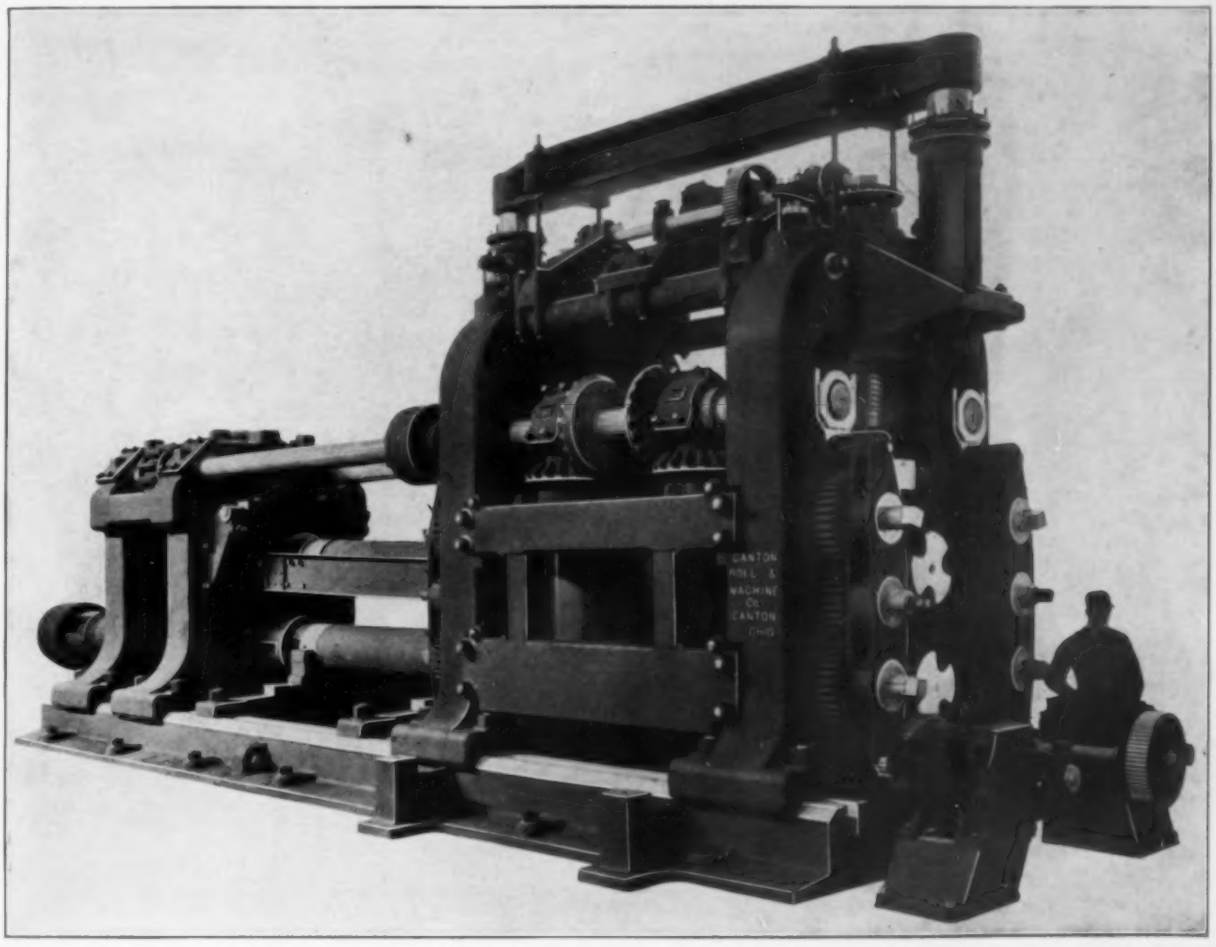


FIG. 9.—34-IN. UNIVERSAL MILL.

considerably larger than the driven—the wrong relation—the open bearings must weaken the housings. These difficulties were eliminated in the following manner: The upper and lower rest bars are rigidly connected with each other and rest in pockets on the inner side of the housings. They are firmly held in place by wedge bolts, but after these are removed a lift of 3 inches is sufficient to disengage the rest bars altogether. The bearings for the drive shafts are located in oblong windows in the housings, allowing sufficient lift to disengage the bevel gears after the couplings have been removed. The pressure screws are then disconnected and run back into the housings, and the complete system of rest bars carrying the vertical rolls is taken out. For quick changes a second system is ready to be put in place, the whole operation occupying less than thirty minutes. Two additional feed rollers can be substituted on each side for the vertical rolls, and the horizontal plate rolls can be exchanged for grooved blooming rolls. The weight of this mill, including the pinions and pinion housings, is over 750,000 lbs. The mill is driven by a pair of reversing engines 34 x 48 inches, geared one to two, built by the Wm. Tod Co., Youngstown, O.

Hydraulic Bloom Shear.

Situated between the mill tables and the straightening bed is the hydraulic bloom shear. The large variety of product and range of sizes made it advisable to adopt a design for this shear which would allow considerable flexibility of the power actually consumed. This was accomplished by arranging two cylinders in tandem, the lower being 40 inches and the upper 23 inches in diameter. The area of the upper cylinder is equal to one-half of the ring area of the lower one, and the power required can be applied consequently in three equal steps, by using either cylinder singly or both together. The knives are 48 inches long and open 10 inches. A depressing table and billet-loading crane are arranged behind the shears. The straightening bed is 110 feet long. A number of dogs force the plate by hydraulic pressure against a rigid guide and in disappearing below the top of the rollers deliver it on to transfer chains. The cooling bed rises slightly and as soon as a plate is pushed over the highest point it slides quickly on to a shear table, at both ends of which a 48-inch motor-driven bar shear is situated.

A 10-ton crane commands this whole machinery. All auxiliary tables, transfers, etc., are driven by 30-h. p. Westinghouse street-car type, enclosed motors, and the power for these, the cranes, etc., is generated by two Gonghnour 150-k. w. 250-volt dynamos, direct connected to Skinner engines. Six Lynn vertical boilers of A. S. M. E. rating of 250 h. p. each are located conveniently to the large engines. The coal is brought over the same elevated track which supplies the producers. The hydraulic pump, accumulator, boiler feed pumps and feed water heater occupy the lean-to of the boiler house. The water supply is furnished by a well 12 feet in diameter and 30 feet deep, situated near the open-hearth furnaces. The water, which is remarkably pure and well adapted for boiler purposes, is forced by a depressed pump into a standpipe and then distributed. All buildings are of steel construction and are covered by sheeting made of genuine muck bar, with the exception of the engine building, where brick filler walls are used. The buildings were manufactured and erected by the Fort Pitt Bridge Works.

Cost of the Plant.

The cost of this plant proved satisfactory. Although most of the equipment was contracted for before the boom in iron and steel subsided, the total sum expended did not exceed $420,000, leaving a margin sufficient to cover the completion of the third open-hearth furnace. This amount is distributed as follows:

Buildings	$ 70,300
Foundations and Grading	39,600
Pit Furnace	13,200
Open-Hearth Furnaces	66,600
Producer Plant	21,400
Cranes, Charging Machine, Etc.	45,100
48-in. Universal Mill	58,600
Auxiliary Tables and Shears	48,000
Boilers	23,500
Engines, Pumps and Dynamos	43,100
Steam Fitting, Wiring and Lighting	27,200
Scales, Buggies, Track, etc.	18,400
	$475,000

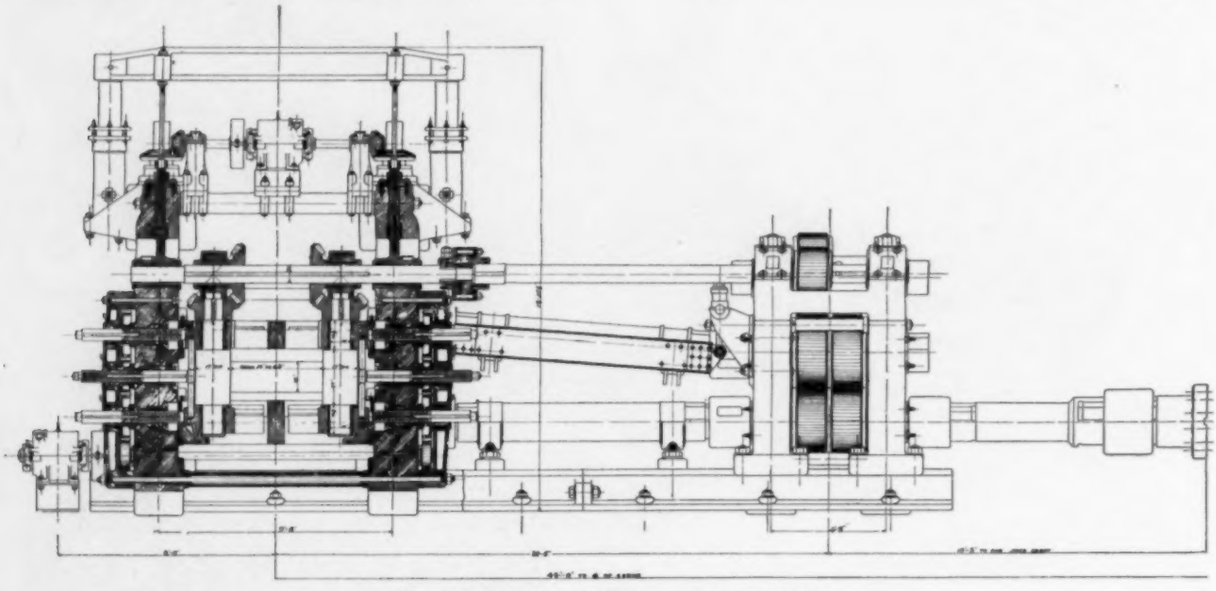


FIG. 10.—SECTION OF 34-IN. UNIVERSAL MILL.

Points in the Choice of Mill.

It might be interesting to follow up briefly the considerations which led to the selection of this equipment and which explain its advantages for the purpose given. The first suggestion which offered itself as a solution of the conditions stated above, was a three-high 22-in. mill equipped with some auxiliary tables, rolling a bar of 90 ft. length in grooves. Such installation is not expensive and its operation fairly economical. Its great obvious disadvantage is the necessity of starting with a 10-in x 10-in. pass requiring bottom cast ingots, for which, owing to the greater labor and the great percentage of scrap, the cost of conversion exceeds by $1.10 the

corresponding figures for a plant pouring standard size ingots by top casts. It is further rather difficult to roll without cumbersome changes, other products on such mill, and it was feared that it would be difficult to dispose of the additional amount of sheet bars, which would be required for an economical operation of the mill.

A universal mill, on the other hand, of the type installed uses a full size ingot, allowing the steel plant to take advantage of every known economical method. Every rectangular section within the range of the mill—and a large range at that—can be rolled from the ingot to the finished product, changing from one size to the other by merely adjusting the mill. The molds are all 14 in. thick inside, graduated from 3 to 3 in. in width to avoid undue strain upon the vertical rolls. All sizes can be finished in one heat, with probably the only exceptions of 12-in. and 14-in. pipe skelp, or universal plates of small gauge and great width. But the high price which these products command allows a comfortable margin for shearing into blooms and reheating. Sheet and tin bars are rolled to a width which is equal to the desired length of the bar, and sheared 7 to 8 in. wide. Sheet bars of the same length but different weight can thus be obtained from one rolling by adjusting the width. The saving in crop ends through this method is also considerable. Universal plate for structural or other purposes and skelp can readily be manufactured, a straightening device having been provided for with this intention. The heavy bloom shear will shear large sections—about 120 sq. in. of hot material—and blooms and slabs of a great variety of sizes can be got out. A large billet order—if it should appear desirable to accept such—can be taken care of by substituting grooved rolls for the plate rolls. The three 40-ton open-hearth furnaces should average 40 heats or 1,600 tons per week, or 900 tons more than the Carnahan Tin Plate Co. and the Stark Rolling Mill Co. at present require. But this surplus can be converted into such great variety of products, that it should not prove difficult to keep the mill filled with orders. The mill is capable of handling over twice the present steel output and is operated only during the day. This arrangement increases the cost of heating somewhat, but keeps the cost of rolling at a very economical basis. Since the capacity of the mill is ample and only limited by the steel capacity, the cost of manufacture will be the same for any type of product, making it naturally desirable to operate on those which bring the highest market price.

Cost of Production.

The following table of the cost of production has been prepared, not with the intention of showing remarkable results, but rather with the desire to take into account the unsettled conditions which must prevail in a new plant, and to demonstrate beyond doubt its earning ability under adverse conditions and at figures which must appear safe.

COST OF PRODUCTION OF SHEET BARS OR UNIVERSAL PLATE, OPERATING THREE 40-TON FURNACES, AVERAGING 40 HEATS PER WEEK.

Material Required per Week.

640 tons	Pig Iron	@	$12.00 per ton	$ 7,680 00	
916 tons	Scrap	@	10.00 per ton	9,160 00	
12 tons	Ferro-mang.	@	52.00 per ton	624 00	
64 tons	Ore (50% Fe.)	@	4.50 per ton	288 00	
				$17,752 00	$17,752 00
15 tons	Magnesite	@	$21.00 per ton	$ 315 00	
25 tons	Dolomite	@	3.50 per ton	87 50	
144 tons	Limestone	@	.60 per ton	86 40	
8 tons	Fluorspar	@	10.00 per ton	80 00	
680 tons	Gas Coal	@	2.20 per ton	1,496 00	
32 tons	Moulds & Stools. (conversion)	@	6.25 per ton	200 00	
	Clay, Brick, Nozzles, etc.			120 00	
				$ 2,384 90	$20,136 90

Labor per Week.

2	Melters	@	$5.50 per day	$ 66 00	
6	First helpers	@	2.75 per day	104 40	
12	Second Helpers	@	1.65 per day	118 80	
2	Steel pourers	@	3.00 per day	36 00	
6	Pitmen	@	1.75 per day	63 00	
2	Cranemen	@	3.00 per day	36 00	
2	Charging mach. men	@	2.25 per day	27 00	
1	Ladle man	@	2.00 per day	12 00	
2	Gas makers	@	2.50 per day	30 00	
4	Helpers	@	1.65 per day	39 00	
20	Laborers	@	1.35 per day	162 00	
2	Chemists			40 00	
				$ 724 80	$20,861 70

Deduct 8% for waste and loss from 1,600 tons:
1,472 tons ingots cost $20,861.70 or $14.17 per ton.

Cost of Heating 1472 Tons of Ingot per Week.

380 tons	Gas coal	@	$2.20 per ton	$ 836 00	
1	Heater	@	4.00 per day	24 00	
4	Helpers	@	2.00 per day	48 00	
2	Gas makers	@	1.65 per day	19 80	
2	Crane men	@	2.25 per day	27 00	
				$ 954 80	$21,816 50

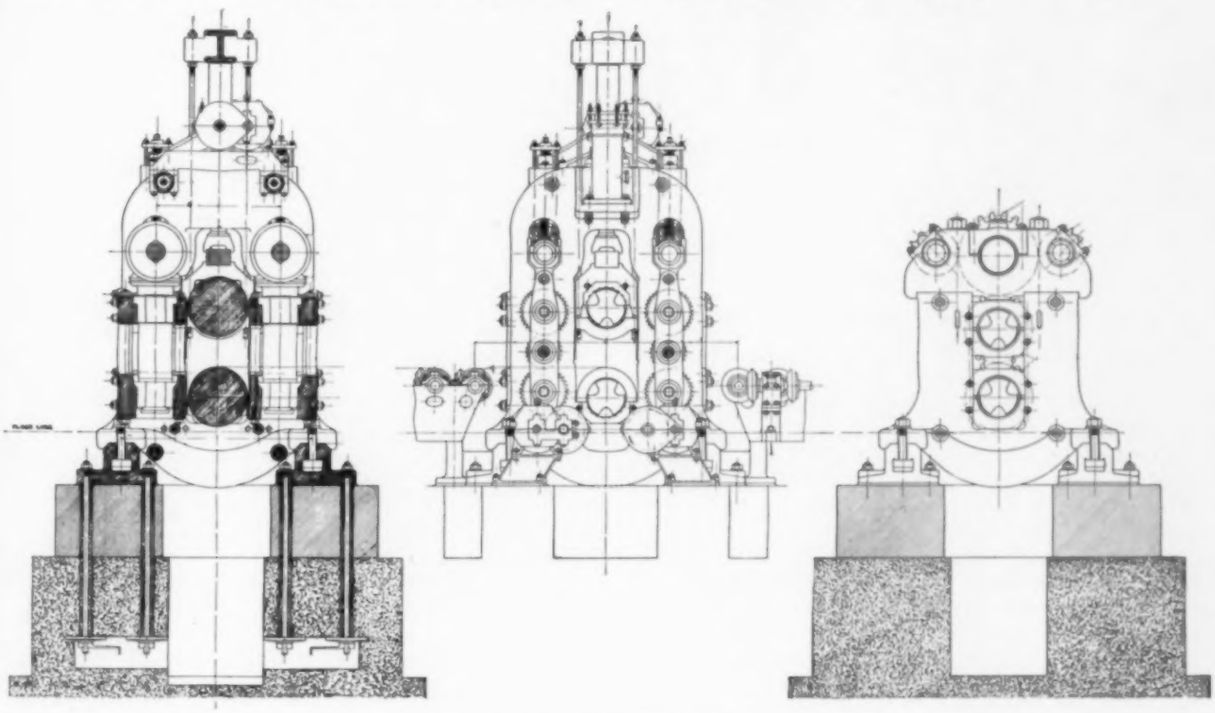


FIG. 11.—SIDE VIEW OF UNIVERSAL PLATE MILL.

Cost of Rolling 1472 Tons of Ingots per Week.

1 Roller	@ $5.00 per day	$ 30 00	
2 Catchers	@ 2.00 per day	24 00	
1 Engineer	@ 3.00 per day	18 00	
1 Manipulator man	@ 2.00 per day	12 00	
3 Shearmen	@ 2.00 per day	36 00	
2 Levermen	@ 1.75 per day	21 00	
1 Craneman	@ 1.75 per day	10 50	
1 Engine tender	@ 2.00 per day	12 00	
10 Laborers	@ 1.35 per day	81 00	
		$ 244 50	$22,061 00
Deduct 2% loss for heating and rolling	= 1,433 tons.		
Deduct 4½% Scrap	= 1,369 tons.		
Credit 64 tons Scrap	@ $10 per ton	$ 640 00	
			$21,421 00

General Operating Expenses to Produce 1369 Tons of Finished Material per Week.

520 tons Steam Coal	@ $1.60 per ton	$ 832 00	
Oil, etc.		225 00	
2 Water tenders	@ $2.00 per day	24 00	
6 Firemen	@ 1.75 per day	63 00	
1 Electrician		25 00	
2 Light engineers	@ $2.00 per day	24 00	
2 Locomotive engineers	@ 2.50 per day	30 00	
1 Millwright	@ 2.75 per day	16 50	
2 Helpers	@ 1.75 per day	21 00	
1 Blacksmith	@ 2.50 per day	15 00	
1 Helper	@ 1.75 per day	10 50	
2 Weigh Clerks	@ 1.50 per day	18 00	
1 Bricklayer		22 00	
		$ 1,325 00	$22,746 00
Office and selling expenses		$ 300 00	
Deterioration, 10% on $475,000		900 00	
		$ 1,200 00	$23,946 00

1,369 tons finished material costs $23,946.00 or $17.50 per ton.

The Question of a Living Profit.

Assuming that one-half of the output of such mill could be turned into sheet bars and the other half into universal plate, and accepting $21.50 and $28 per ton as bona fide prices, we would find an average profit of $7 per ton or $560,000 for the total per year. For sheet bars alone, this profit would be equal to $285,000. If the price of bars should drop to $20 without bringing about a corresponding cut in pig iron, the profits would still amount to $178,000. On a capital of, say, $600,000 the above profits would be equal to 93, 47 and in the worst case to 30 percent interest. For reasons given above the dominant elements in the steel trade are not likely to permit a further reduction in price of the intermediate products preferring to inject in retaliation, a rate war into any of the finishing branches. This occurred but a few days ago. It must further be taken into consideration that the Steel Corporation must earn $7 per ton of output to cover its fixed charges. This figure is based upon the output in a normal year, and must therefore be increased at times when unfavorable market conditions decrease the demand and under ordinary circumstances would cause a sharp reduction in prices. This $7 per ton must be distributed over every step in the manufacture of steel and a considerable proportion is beyond doubt taken care of by the admirable equipment and methods in mining and transporting the raw materials and in making pig iron. But if only a small part of this burden is shouldered by the steel plants of the trust, the handicap arising therefrom might equalize conditions and possibly even afford a comfortable profit to the independent plant.

The products treated in this article do not offer the only field for a successful competition. The manufacture of structural shapes on a limited but economical basis presents a highly interesting field, which can also be readily entered, and the production of rods and merchant bars has been ably discussed in *The Iron Trade Review* from the same point of view. And it must be admitted that with minimum earnings of 30 percent on the invested capital, as indicated above, the situation of the independent manufacturer does not appear altogether desperate.

FOUNDRY FOREMEN OF PHILADELPHIA.

The Associated Foundry Foremen of Philadelphia and vicinity, were formed as a permanent organization Oct. 19, when a meeting was held at the Manufacturers' Club. The benefits to be derived from the association were fully discussed. The following officers were elected: President, A. T. Williams, Enterprise Mfg. Co.; vice president, James B. Strain, Robert Wetherill & Co.; secretary, W. P. Cunningham, American Bridge Co.; and treasurer, George M. Benkert, Williamson Bros. Co. At the first meeting 16 became members of the association and as many signified their intention to do so. There were 29 present, including Howard Evans, secretary of the Philadelphia Foundrymen's Association, and F. C. Everett, of New York, secretary of the Associated Foundry Foremen of that city. The Philadelphia Foremen have received a great deal of valuable assistance from Mr. Evans in getting the foremen together, and he was tendered a vote of thanks. Among those present were the following:

F. C. Everett, J. L. Mott Iron Works, New York.
A. T. Williams, Enterprise Mfg. Co., Philadelphia.
W. P. Cunningham, American Bridge Co., Philadelphia.
Thomas Mann, Philadelphia.
Thomas Pole, Philadelphia.
W. P. Miles, Floyd Wells & Co., Royersford, Pa.
W. O. Steele, Bateman Mfg. Co., Grenloch, N. J.
Wm. Cook, Haines, Jones & Cadbury Co., Philadelphia.
Jas. Linahan, Philadelphia.
Andrew Barr, Philadelphia.
C. R. Brown, E. E. Brown & Co., Philadelphia.
Jas. B. Strain, Robert Wetherill & Co., Chester, Pa.
Jas. T. Noden, Chester, Pa.
H. Cadwallader, B. B. Hill Mfg. Co., Philadelphia.
John F. Elliott, Philadelphia.
Henry W. Kramer, Wm. Adams Foundry Co., Philadelphia.
John Patton, North Wales Foundry Co., North Wales.
Ed. T. Spur, Enterprise Mfg. Co., Philadelphia.
Geo. Scholley, Delaware Foundry Co., Burlington, N. J.
E. Arlgobert, Williamson Bros. Co., Philadelphia.
John McGuigan, North Bros. Mfg. Co., Philadelphia.
Chas. D. Orr, Thomas, Roberts Stevenson Co., Philadelphia.
M. F. Heyburn, United States Navy Yard, Philadelphia.
John Hynes, James Smith Woolen Mchy. Co., Philadelphia.
George M. Benkert, Williamson Bros. Co., Philadelphia.
Geo. Moyer, Enterprise Mfg. Co., Philadelphia.
William Hanson, Philadelphia.
Jos. L. Ruth, Pottstown Machine Co., Pottstown.
Fred. Koch, Williamson Bros. Co., Philadelphia.

Grand Prize for Allis-Chalmers Engine.

"Big Reliable," the monster engine of the Allis-Chalmers Co., which won the grand prize at the World's Fair, proved the wonderful accuracy of the West Allis shops. So true to the original drawing was every piece that although the various parts of the engine had never been assembled until they arrived in Machinery Hall at the World's Fair in something like 40 cars, each part fitted exactly into its place and from the moment the steam was turned into the engine until the present time it has been running in perfect order, without a moment's loss because of a breakdown. The grand prize for the big engine, which became known as "Big Reliable," was the only such award given for an American engine. The award was made upon the record for performance together with the known record of the same type of engine for economy. The Allis-Chalmers exhibit occupies all of one end of Machinery Hall, the big engine standing in the center.

The increase in mechanical efficiency of engines with forced lubrication has been clearly shown by recent engines built by the B. F. Sturtevant Co., at Hyde Park, Mass., and fitted with forced pump lubricating system. An increase of from 8 to 10 percent is shown, and with the latest type of vertical single engines a mechanical efficiency averaging 94 percent is attained.

Application of Dry-Air Blast to the Manufacture of Iron.*

BY JAMES GAYLEY.

The atmosphere, which plays such an important part in the manufacture of iron and steel, is the most variable element to contend with in its several processes; and particularly is this true of the blast furnace process, which consumes air in large quantities. At no time since the blast furnace became an important and widely used apparatus—even when it was operated in the most crude manner—have the variations in composition of the raw materials used been as frequent and as great as the variations in humidity of the atmosphere. Great and important improvements have been made in the blast furnace and its accessories, as in the hot blast stoves, the increase in size and change in the shape of the furnace, more efficient blowing engines, the increased protection given to the bosh walls, and in the careful preparation of the raw material, all of which have exerted a pronounced influence on the furnace operations from a metallurgical standpoint.

During the past eight years but little advance has been made in this direction; the fuel consumption has not diminished, nor has there been any material increase in production. Within this period, however, there has been witnessed the greatest development in appliances for the economical handling of material, and so complete has been the work in this direction, that, except in isolated cases, in this country at least, a further extension does not hold out much promise of a satisfactory return on the investment required. It seemed that, with the exception of the gas engine, we had about reached the limit, for like a strong wall, the atmosphere, with its humidity as variable today as when first blown into a primitive blast furnace, appeared to stand as a barrier to further progress. In furnaces using ore from the Lake Superior district the raw material, amounting to about 7,200 pounds per ton of iron, varies in composition within 10 percent and is as uniform as human skill can make it; but the atmosphere, of which 11,700 pounds are consumed per ton of iron, varies in its content of moisture from 20 to 100 percent, from day to day and often in the same day, thus rendering the process, even with the best appliances, an uncertain one and dependent on the caprice of the atmosphere.

The desiccation of the air used in blast furnaces to such extent as to cause a practical elimination of the moisture, or its reduction to a small quantity, and maintaining it uniform, must of necessity contribute in a very marked degree toward the attainment of uniformity in the furnace operations, and the advantages from desiccation can be appreciated only after due consideration is given to the volume of air that is consumed per minute and the large amount of moisture which it contains. Managers of blast furnaces are familiar with the chilling effects produced in the hearth by a tuyere that is leaking, which immediately results in a deterioration in the grade of the iron, and yet the quantity of water ordinarily entering the furnace under these conditions is not greatly in excess of the quantity carried in, like a steady stream, by the atmosphere, during a period of the average humid conditions prevailing in the summer season in this country.

It has been deemed preferable in this communication to express the quantity of moisture contained in the atmosphere, as grains of water per cubic foot of air, inasmuch as the quantity of air blown into blast furnaces is expressed in cubic feet. With air containing 1 grain of water per cubic foot, there is passed into the furnace, for each 1,000 cubic feet used per minute, practically 1 gallon of water per hour. The furnaces of average size in the Pittsburg district consume about 40,000 cubic feet of air per minute, which would pass into the furnace 40 gallons of water per hour for each grain of moisture contained in a cubic foot of air. The quantity of moisture in the air, taken from daily readings by the observer of the United States Weather Bureau at Pittsburg, is set forth in Exhibit I.

Exhibit I.

	Average Temperature.	Grains of Water per Cu. Ft. of Air.	Gallons of Water Entering per Hour into a Furnace Using 40,000 Cu. Ft. Air per Minute.
January	37.	2.18	87.2
February	31.7	1.83	73.2
March	47.	3.4	136.
April	51.	3.0	120.
May	61.6	4.8	192.
June	71.6	5.94	237.6
July	76.2	5.6	224.
August	73.6	5.16	206.4
September	70.4	5.68	227.2
October	56.4	4.0	160.
November	40.4	2.35	94.
December	36.6	2.25	90.

The above exhibit, like all records made by the Weather Bureau, is from observations taken on the top of a high building, and does not correctly indicate the condition of the atmosphere at the furnaces where the air is used. In fact, at one of the steel works in Pittsburg, observations made simultaneously at three separate stations showed quite a little variation in moisture. For the purpose of comparison with observations of the Weather Bureau, there is shown in Exhibit II. the average monthly content of moisture in the air at the furnaces, the observations being made at 9 a. m.

Exhibit II.

	Grains of Water per Cu. Ft. of Air.
January	2.8
February	2.7
March	3.1
April	3.3
May	4.7
June	7.3
July	7.0
August	7.1
September	5.4
October	3.2
November	3.3
December	3.0

NOTE.—All tons are gross of 2,240 pounds, and all temperatures are Fahrenheit.

The variations in moisture from month to month set forth clearly the conditions, as to atmosphere, with which blast furnaces in this country have had to contend. If these conditions were uniform throughout the whole month, it would not be a difficult problem to deal with; but unfortunately they are not uniform, and it is instructive to note the changes which occur from day to day in the same month. In Exhibit III. is shown a record worked out from data furnished by the Pittsburg Weather Bureau. These observations represent a different period from that shown in Exhibit I.; they were taken at 8 a. m. and 8 p. m., and show the grains of water per cubic foot of air at the time observed, for the months of January and July.

Exhibit III.

	JANUARY. Grains of Water.		JULY. Grains of Water	
Day.	8 A. M.	8 P. M.	8 A. M.	8 P. M.
1	1.96	3.06	7.24	7.48
2	2.55	3.66	8.23	7.98
3	2.46	3.80	8.50	7.48
4	2.07	2.27	8.50	7.48
5	1.81	1.12	8.46	7.72
6	.99	1.12	6.50	8.24
7	1.16	1.67	8.78	7.47
8	1.49	1.88	7.98	7.24
9	1.96	2.19	6.78	5.94
10	1.81	1.88	7.48	6.35
11	1.74	1.55	7.98	7.48
12	1.55	1.07	6.73	6.35
13	.90	1.55	5.94	4.84
14	1.61	1.81	5.55	5.74

*Prepared for the New York meeting of the Iron and Steel Institute, Oct. 26, 1904.

15	1.67	1.96	5.74	5.19	29	.76	.80	6.14	5.01
16	2.04	2.27	6.35	6.35	30	.95	1.12	5.74	6.35
17	2.45	3.29	7.72	7.98	31	.70	1.41	6.56	5.19
18	1.81	1.32	7.24	7.24					
19	1.12	1.16	8.24	7.48					
20	1.43	2.11	7.48	7.24					
21	2.11	1.88	7.72	7.38					

It will be observed in the preceding exhibit that, while the moisture in the atmosphere in the month of January is much less than in July, yet the percentage of variation is greater.

Exhibit IV.

April	A.M.							P.M.											A.M.				
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
1	2.77	3.30	3.71	3.71	3.09	3.46	3.46	3.46	3.46	3.46	3.46	4.11	3.71	3.71	3.71	3.30	3.71	3.71	3.71	3.30	3.71	3.71	3.71	3.09
2	3.71	3.71	3.30	3.30	3.71	3.71	3.46	3.46	3.46	3.81	3.46	3.81	3.09	3.81	3.30	3.77	2.77	3.71	3.71	3.71	3.71	3.71	3.68	3.30
3	3.09	3.09	3.09	3.09	3.46	3.46	3.46	3.09	3.09	3.46	3.09	3.30	3.30	3.02	3.02	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30
4	3.71	3.71	3.71	3.71	3.71	4.11	4.11	4.67	4.67	3.81	3.81	4.11	3.30	4.01	3.30	3.71	4.01	3.71	3.71	3.30	3.38	3.30	3.30	4.01
5	3.68	3.68	4.01	3.30	4.01	3.89	3.71	4.11	4.11	3.46	4.11	4.11	4.11	3.46	3.09	3.09	3.09	2.47	2.77	2.77	2.77	2.77	2.77	2.77
6	2.47	3.09	3.09	3.09	3.71	3.71	3.71	3.71	3.46	3.46	3.71	3.71	3.71	3.71	3.71	3.71	3.09	3.30	3.30	3.30	2.77	2.77	2.77	2.47
7	2.77	3.30	3.30	2.77	4.01	3.30	3.71	3.81	4.11	4.33	4.67	4.67	4.11	4.01	3.30	3.30	3.71	3.71	3.30	3.30	3.30	3.30	3.30	3.30
8	3.02	3.30	4.01	3.30	3.71	3.71	3.71	4.11	4.11	4.40	4.40	4.40	3.71	3.71	4.01	4.01	3.30	3.30	3.30	3.30	3.30	3.02	3.02	3.30
9	3.68	3.68	3.71	4.11	4.11	4.11	4.28	4.67	4.01	4.01	4.31	4.31	3.68	3.68	3.68	4.01	3.68	3.68	3.30	3.39	3.39	3.02	3.39	3.02
10	3.68	3.68	3.98	3.68	3.68	4.01	3.71	3.71	4.67	4.17	5.11	5.46	5.11	5.35	5.11	5.14	5.35	5.20	4.75	4.40	4.75	4.40	4.75	4.75
11	4.75	4.31	4.40	5.01	4.33	5.28	4.56	4.56	5.22	5.22	5.22	5.22	4.24	4.96	3.81	3.81	3.46	3.46	3.81	3.81	3.46	3.46	3.46	3.46
12	3.46	3.46	3.30	3.46	3.98	3.30	3.84	3.68	3.47	3.20	3.52	3.52	3.17	3.11	2.74	3.98	3.46	3.71	3.71	3.09	3.09	3.30	3.30	3.30
13	3.02	3.68	3.71	4.01	4.96	4.71	5.22	4.85	4.59	4.85	4.56	4.56	4.56	4.96	4.96	4.67	4.81	5.01	5.01	4.75	4.75	4.31	4.31	4.31
14	3.68	3.68	3.68	3.68	4.31	4.01	4.01	4.01	4.01	4.31	4.31	4.40	4.31	4.31	4.31	4.31	4.31	3.98	4.31	3.68	3.98	4.31	3.98	3.98
15	4.01	4.01	3.71	4.40	4.41	4.75	4.33	4.96	4.56	4.24	4.24	4.24	4.33	3.81	4.11	3.81	3.46	3.30	3.30	3.30	3.30	3.68	3.62	3.62
16	3.68	3.68	4.01	3.81	3.81	4.67	3.52	4.96	4.96	4.96	4.96	4.96	4.96	5.01	4.40	4.40	4.11	4.75	4.46	4.67	5.01	5.01	5.01	5.01
17	5.01	4.67	5.60	5.26	5.28	5.97	6.27	6.27	6.27	6.27	5.83	6.27	6.25	5.60	5.60	5.60	5.35	5.35	5.77	4.40	4.75	4.75	4.75	4.52
18	4.75	4.75	5.35	5.35	5.35	5.32	5.60	6.08	6.43	6.43	6.62	5.84	5.84	5.84	5.77	5.77	5.11	5.11	5.77	5.77	5.77	5.35	5.77	5.77
19	5.77	5.35	5.77	5.77	6.32	5.77	6.32	6.32	6.32	6.32	6.32	5.84	6.72	5.77	4.75	4.75	4.75	4.01	4.01	4.31	3.30	3.30	3.30	4.01
20	4.01	3.30	3.30	3.30	3.30	3.30	3.30	3.71	4.40	4.40	4.40	4.40	3.71	3.30	3.30	3.30	3.30	3.09	3.30	3.30	3.30	3.30	3.30	3.30
21	4.01	4.40	4.40	3.71	3.71	4.40	4.11	4.11	4.11	4.67	5.01	5.01	5.35	4.01	4.01	4.01	5.11	4.75	4.31	4.01	4.01	4.31	5.11	4.31
22	3.30	4.01	3.46	3.71	4.11	4.11	4.33	4.56	4.98	5.22	5.59	5.10	4.24	4.24	4.56	4.24	5.22	5.22	5.22	5.59	5.59	5.28	5.01	4.40
23	5.35	5.01	5.01	5.60	5.28	5.28	5.84	5.35	6.18	6.18	6.18	6.18	6.18	6.39	6.39	6.18	6.18	6.18	5.77	6.18	6.18	6.18	5.11	5.11
24	5.46	5.11	5.11	5.11	5.11	5.11	5.11	5.11	4.75	5.11	4.75	5.77	4.75	5.11	5.11	5.46	5.77	5.77	5.35	4.75	4.75	5.11	5.11	4.75
25	4.31	4.41	4.75	4.75	4.40	4.40	4.40	5.01	5.01	5.01	5.01	5.01	4.75	4.75	4.40	4.40	3.71	3.75	4.05	4.00	4.01	4.01	4.01	4.01
26	4.01	4.40	4.11	4.11	4.61	4.67	4.67	4.67	4.67	4.67	4.33	4.33	4.33	4.33	3.71	4.01	4.31	4.01	3.68	4.01	3.30	3.68	3.68	3.68
27	4.31	4.01	4.40	4.11	4.67	4.67	4.96	4.33	4.33	5.28	4.33	4.96	4.67	3.71	4.01	4.40	4.01	4.01	4.01	4.01	3.68	3.68	3.68	3.68
28	3.30	4.01	3.46	3.81	4.11	4.11	4.67	4.67	4.67	5.28	5.28	4.33	5.01	4.40	4.11	4.40	4.40	4.40	3.71	4.31	4.01	4.01	3.71	4.40
29	4.01	4.01	4.40	4.40	4.40	4.11	4.11	3.81	4.40	4.40	4.11	4.40	4.40	4.01	4.31	4.75	4.75	4.07	4.01	4.01	4.01	4.01	4.31	4.01
30	4.01	3.68	4.31	3.81	4.67	4.33	5.60	5.28	5.97	6.43	5.28	5.28	5.84	5.01	5.35	5.77	4.75	4.75	4.75	5.11	4.75	4.75	4.75	4.75

Exhibit V.

October	A.M.							P.M.												A.M.				
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
1	5.46	6.18	7.08	6.62	6.27	6.27	6.64	6.39	6.39	7.73	7.73	7.65	8.15	7.65	7.16	7.08	6.32	7.08	6.32	6.72	6.72	7.20	6.18	6.18
2	7.20	7.92	8.86	9.38	9.02	10.15	10.15	10.15	10.10	10.15	10.15	9.38	10.02	10.02	8.86	8.86	8.86	7.92	7.92	8.86	8.40	8.40	8.40	7.20
3	7.92	7.92	9.38	9.02	9.57	9.57	9.13	9.78	9.78	9.14	10.89	10.15	8.54	8.54	8.54	8.86	7.92	7.92	7.64	8.86	8.54	9.51	7.92	9.05
4	9.05	7.92	8.54	9.02	10.15	10.15	10.15	9.02	10.02	10.02	10.27	10.02	9.02	9.38	9.38	9.02	8.86	8.86	9.05	9.84	9.51	9.84	8.40	9.84
5	8.40	9.51	9.51	8.40	9.51	9.51	9.51	8.86	8.86	8.54	8.54	9.51	7.64	7.64	7.64	7.92	8.40	6.72	7.92	6.72	5.77	5.77	5.77	5.35
6	5.35	5.35	5.35	5.01	5.60	5.28	4.96	5.59	5.22	5.22	5.59	5.28	5.01	5.35	5.11	5.11	5.11	5.11	5.11	5.46	5.99	5.11	5.77	5.11
7	6.18	6.18	5.77	5.35	6.32	6.32	7.64	7.92	7.20	8.40	7.92	7.92	7.52	7.20	7.20	7.20	7.20	7.20	7.20	7.20	7.52	7.52	7.52	6.18
8	7.20	7.20	7.20	6.72	6.72	5.60	5.28	6.43	6.43	5.81	6.32	6.72	6.72	6.72	5.77	5.77	5.77	5.77	6.18	5.77	6.18	5.11	6.18	5.11
9	5.46	5.46	6.18	5.35	4.67	4.56	4.85	5.22	4.85	5.22	4.56	5.77	4.40	5.11	5.11	5.11	4.31	4.31	4.40	5.11	5.11	4.31	4.66	4.66
10	4.66	5.11	4.75	4.75	5.77	6.62	7.47	7.47	8.15	7.25	6.71	7.47	7.08	7.08	7.08	7.47	7.25	6.71	6.71	6.43	6.43	5.60	5.84	.....
11	6.32	6.43	6.71	6.27	5.83	6.39	6.71	5.97	5.35	4.75	4.75	4.75	6.72	5.77	5.77	5.77	5.77	6.18	6.18	4.66	4.31	5.11	5.11	4.31
12	4.31	3.75	4.01	3.81	4.33	3.98	3.71	3.71	3.71	3.98	3.98	3.52	3.52	3.82	3.81	4.01	4.01	4.01	4.31	4.31	4.31	4.31	4.31	4.31
13	4.31	4.31	4.01	5.01	5.28	5.28	4.85	4.85	4.47	4.24	4.24	4.56	4.67	4.67	4.67	4.75	5.35	4.75	5.11	4.75	4.75	4.40	3.81	3.46
14	3.11	3.11	3.46	3.11	3.11	3.11	3.11	2.75	3.46	3.71	3.71	3.71	3.71	3.71	3.71	4.01	4.01	3.71	4.11	4.11	4.11	4.11	3.46	3.46
15	3.81	3.46	3.46	3.11	3.11	3.81	3.81	3.52	3.98	3.52	3.52	3.11	3.81	3.11	4.01	4.01	3.30	3.30	3.68	3.68	3.68	3.68	3.68	3.68
16	3.68	3.68	3.68	4.01	4.11	4.33	4.33	4.33	3.98	3.98	5.01	3.71	4.40	4.01	4.01	4.01	4.01	4.01	4.01	4.01	3.71	3.71	3.71	3.71
17	3.71	3.71	4.40	3.81	3.30	3.84	4.01	4.01	4.01	4.47	4.47	4.47	3.52	3.84	3.84	3.30	4.24	3.30	3.71	4.54	6.67	4.67	4.33	3.81
18	4.40	4.75	4.75	4.75	4.75	4.75	4.75	5.11	4.75	4.75	4.75	4.11	4.11	4.40	4.11	4.40	4.11	4.40	3.71	3.71	3.71	3.71	4.01	3.71
19	3.71	3.68	4.01	4.11	3.98	3.71	3.30	2.95	2.95	3.84	3.84	3.98	3.98	3.81	4.11	3.71	3.46	3.71	4.01	4.01	4.01	3.68	4.01	4.01
20	3.68	3.68	4.01	4.01	4.33	4.56	3.84	4.85	3.82	4.01	4.24	4.24	4.67	4.11	4.11	4.40	4.40	4.40	4.11	4.11	5.01	4.40	4.75	4.75
21	5.77	5.35	5.77	5.77	6.18	5.77	5.77	5.77	5.77	5.35	6.32	5.01	5.35	5.35	5.77	6.72	5.35	5.35	5.77	5.77	4.40	4.40	4.40	3.46
22	3.46	3.46	3.46	3.46	3.46	3.11	3.46	3.46	3.46	3.46	3.46	3.52	3.81	3.81	3.52	3.11	3.11	3.81	3.81	3.81	3.81	3.81	3.81	3.81
23	3.52	3.52	3.17	3.52	2.75	3.52	3.17	3.17	3.52	3.17	3.52	3.11	3.52	3.52	3.11	3.11	3.46	3.46	3.46	3.09	3.71	3.09	3.30	3.30
24	3.30	3.30	3.71	3.46	4.33	3.98	4.96	4.56	4.24	4.24	4.56	4.67	3.81	4.11	4.11	4.11	4.40	3.71	3.71	3.71	3.71	4.01	4.01	3.71
25	4.01	3.30	3.71	4.11	4.33	4.24	4.85	4.85	4.01	4.47	3.84	3.98	4.33	4.11	3.46	3.71	3.71	4.01	4.40	4.40	4.11	4.11	4.11	4.11
26	4.16	3.71	3.46	3.46	2.74	2.75	2.75	2.75	3.11	3.46	3.46	3.09	3.11	3.46	3.11	2.74	2.74	2.74	2.52	2.75	2.23	2.52	2.74	2.52
27	2.52	2.23	2.52	2.23	2.23	2.23	2.23	2.75	2.75	2.45	2.45	2.52	2.74	2.74	2.74	3.09	3.09	3.09	2.47	3.09	3.09	3.09	2.47	3.09
28	3.30	3.30	2.74	3.46	2.75	2.75	2.94	2.94	3.30	3.30	2.94	2.75	2.74	3.11	3.46	2.74	3.09	3.46	2.74	3.09	3.46	3.09	3.09	3.30
29	2.74	2.74	2.74	3.09	2.75	3.52	3.71	2.95	3.30	3.30	2.58	3.81	3.11	3.11	3.46	3.11	3.46	2.75	3.11	3.11	3.09	3.09	3.09	3.09
30	3.30	3.46	3.30	3.46	4.01	3.71	3.46	3.46	3.46	3.11	2.75	3.17	2.75	3.11	3.46	3.46	3.11	3.11	3.11	3.11	3.46	3.46	2.74	3.71
31	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.71	3.46	3.46	3.46	2.75	3.46	3.46	3.09	3.09	3.09	3.09	3.09	3.30	3.39	2.77	3.09	3.30

NOTE.—DATA IN EXHIBITS IV. AND V. REPRESENT GRAINS OF MOISTURE PER CUBIC FOOT OF AIR.

22	1.88	1.88	6.78	5.74
23	.91	1.17	7.43	6.35
24	.99	2.11	6.56	6.11
25	.69	1.83	6.05	7.74
26	.61	.99	7.72	7.32
27	.56	.88	7.98	7.48
28	.72	.70	6.56	5.74

In order to illustrate more precisely the exact conditions with respect to the atmosphere, under which blast furnaces must be operated, there is shown in Exhibits IV. and V. a record of observations taken each hour in the day, and in order not to make the data too burdensome the months of April and October have been selected, as they represent months between

the warm and cold seasons, and will also serve for comparison with January and July, as shown in Exhibit III.

It should be stated with reference to the Exhibits IV. and V., that observations were taken with a stationary instrument, which shows results somewhat higher, and not as accurate, as those taken with a whirled psychrometer. Nevertheless, they were taken with the same instrument and are relatively correct. By simply multiplying the grains of moisture by 40—which represents the number of gallons of water entering a modern furnace per hour, for a content of 1 grain of moisture in a cubic foot of air—a clear idea can be had of the gallons of water entering the furnace per hour, for the various conditions of humidity. The changes are great not only from day to day, but from hour to hour in the same day, and often they are very abrupt. These records were made at a furnace plant, located on the bank of a river, where the conditions exist for an increase in humidity as compared with higher ground; and to what extent the abrupt changes may have been caused by the presence of steam in the atmosphere—absorbed from spraying of the hot pig beds, the blow-off from boilers and exhaust from engines, or from a rain storm, when the humidity decreases suddenly—it is impossible to say. How frequently has it happened in the experience of every furnace manager, that the furnace has gradually or suddenly lost its hearth temperature and produced a grade of iron either undesirable or unmarketable, without any visible cause. Tuyeres are examined for leaks, the raw material in the stockyard is carefully inspected, and usually the coke is condemned. A more intimate acquaintance with the atmosphere would have provided a correct and ready reason, for the variations therein are not only many times greater than in the raw material, but a greater weight of it is used per ton of iron.

It is true that the atmosphere has been recognized by many metallurgists as the cause of many and serious irregularities in blast furnace operations, but it is doubtful if its influence has been adequately recognized. Many writers on metallurgical subjects have considered the moisture in the atmosphere, and calculated the absorption of heat necessary for its dissipation—and invariably underestimated; and have dismissed the subject with the conclusion that to extract the moisture the game was not worth the candle, or in a spirit of resignation accepted it—like storm and sunshine—as a condition beyond our control. This conclusion has no doubt been reached by a consideration alone of the quantity of fuel necessary to dissipate the moisture in the furnace hearth, based on observations of the humidity of the atmosphere taken outside the blowing engine room, and this quantity, while important, does not indicate a great saving in fuel. Of much greater importance is the variation in moisture from time to time and the margin of heat carried in the furnace to compensate for these variations, which margin is invariably large; and every furnace manager is aware of its existence, from the way in which he is required to manipulate the hot blast temperatures, and from the silicon in the metal, which is the thermometer of the hearth.

It has often been a matter of surprise that a greater saving of fuel per ton of iron was not obtained in the winter, as compared with the summer season, as the records show a much less content of moisture in the atmosphere, the reason being that blowing engines at blast furnaces do not receive air of the dryness as shown in the exhibits above. In summer the windows and doors of the blowing engine room are wide open, and the supply of air, with reference to humidity, is practically that of the atmosphere; but in winter they are nearly or quite closed, and the entering air has mixed with it all of the steam that leaks from the engine and is contaminated therewith. Records taken over a number of years show that there is not a very great difference in the moisture in atmosphere between observations taken outdoors in summer and in the engine room in winter. In Exhibit VI. are monthly records showing a comparison between winter and summer months, the observations having been taken indoors and outdoors respectively.

Exhibit VI.

Winter. Month.	Grains of Water per Cu. Ft. of Air.	Summer. Month.	Grains of Water per Cu. Ft. of Air.
January	4.5	April	4.2
February	4.6	May	4.1
March	4.7	June	6.4
October	6.4	July	5.2
November	4.6	August	6.7
December	5.0	September	5.7

A comparison of the data given in Exhibit VI. with Exhibit II. would suggest that a great advantage could be derived by leading pipes from outdoors to the inlet valves of the air cylinder, and it certainly appears that a material advantage could be gained. So impressed was the writer with this conclusion that the blowing engines at a furnace under his direction were so equipped in the month of January, and continued to draw the supply of air from outdoors throughout the year. The excellent results expected in the winter season did not materialize, or rather were so slight, as compared with a companion furnace not so equipped, as to argue against any extension along that line. This experience suggested the conclusion that while the air in the engine room was higher in its content of moisture, through its admixture with steam, than the outside air, yet it was not subject to the same variations; and further that these variations, which were often sudden and great, were really the most troublesome feature, and that nothing less than maintaining the atmosphere uniform with respect to humidity would prove of any material advantage. The saving in fuel through such uniformity could not be accurately set forth. The amount of fuel necessary for the decomposition of the moisture in the blast can be closely arrived at, but to what extent that which might be designated as the surplus of heat, utilized for counteracting the variations in moisture, could be diminished, must of necessity be an approximation, as there existed no tangible data for estimating it. Nevertheless, the saving therein was deemed to be considerable.

FIG. I.—ISABELLA FURNACE NO. I.

It may reasonably be assumed that in order to determine the most feasible method and apparatus for extracting the moisture, a wide field of experiment must be covered. Various schemes for absorbing the moisture were worked out and in turn abandoned, and refrigeration by means of anhydrous ammonia was chosen. After many preliminary experiments an insulated chamber containing coils of pipe, and of sufficient size to treat the air from a blowing cylinder 3 feet in diameter, was built. A small ice machine was installed to circulate the ammonia through the coils, and the air was admitted to the refrigerating chamber from an auxiliary chamber in which steam could be introduced at will, thus making it possible to treat, at any time, air containing the maximum amount of moisture with which it would be necessary to contend in the summer months. In this experimental plant air was treated under a variety of conditions for quite a period, and from the data obtained the equipment for a modern furnace was worked out.

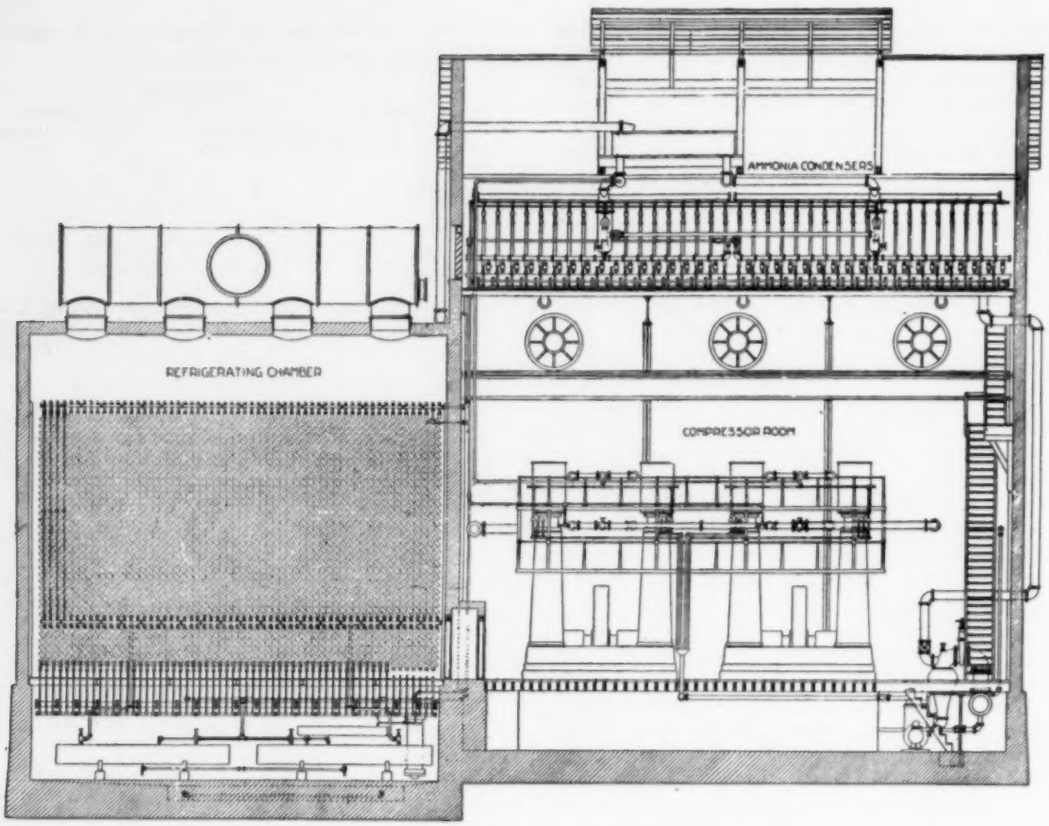


FIG. 2.

The Isabella furnaces of the Carnegie Steel Co., located at Etna, Pa., a suburb of Pittsburg, were selected as the plant at which to install the apparatus for applying the dry air blast. The lines and dimensions of this furnace are shown in Fig. 1, and represent the usual construction of furnaces in the Pittsburg district. The furnace is blown with twelve 6-in. tuyeres, and is equipped with four hot blast stoves. Blast is supplied by three blowing engines having the following dimensions: Steam cylinder, 44 in. diameter; air cylinder, 84 in.; stroke, 60 in.

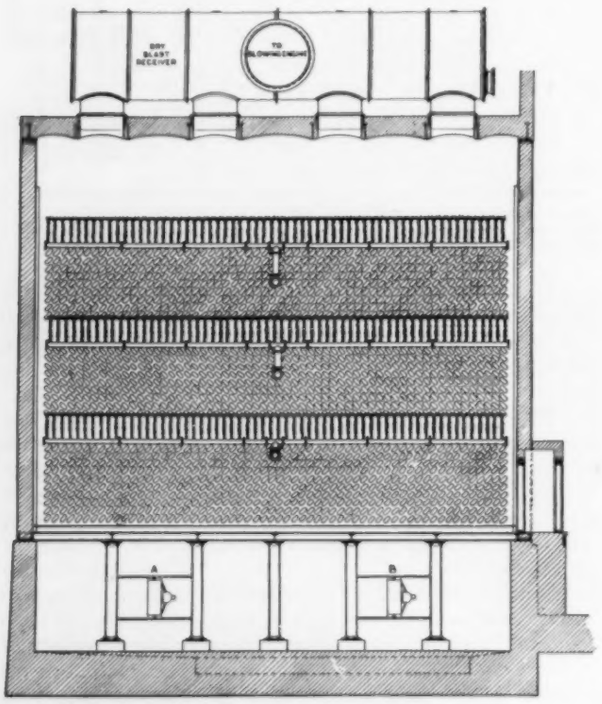


FIG. 3.—REFRIGERATING CHAMBER.

In Fig. 2 there is shown in elevation the ammonia compressors, condensers, and the refrigerating chamber. This view of the refrigerating chamber shows it to be connected for the direct expansion of ammonia, but as the escape of ammonia gas through a broken pipe or leaking joint might imperil the life of anyone in the chamber at the time, it was decided to adopt the brine system, and the pipe connections are as shown in Figs. 3 and 4, representing the refrigerating chamber in end view and vertical section. The refrigerating chamber is lined on the inside with plates of compressed cork 2 in. thick.

Exhibit VII.

	Without Dry-Blast.			With Dry-Blast.	
	Product Tons.	Coke Consumption Pounds.		Product Tons.	Coke Consumption Pounds.
Aug. 1,	360	2,210	Aug. 25,	462	1,766
" 2,	367	2,112	" 26,	441	1,850
" 3,	372	2,084	" 27,	477	1,668
" 4,	373	2,133	" 28,	516	1,462
" 5,	386	2,008	" 29,	405	1,763
" 6,	340	2,280	" 30,	441	1,804
" 7,	347	2,116	" 31,	462	1,722
" 8,	360	2,012	Sept. 1,	472	1,729
" 9,	378	2,114	" 2,	472	1,642
" 10,	352	2,318	" 3,	458	1,648
" 11,	306	2,266	" 4,	421	1,841
			" 5,	450	1,813
			" 6,	400	1,638
			" 7,	400	1,734
			" 8,	397	1,952
			" 9,	472	1,642
Average,	358	2,147	Average,	447	1,726

The ammonia machines are of the compressor type, and were built by the York Mfg. Co., York, Pa. The dimensions

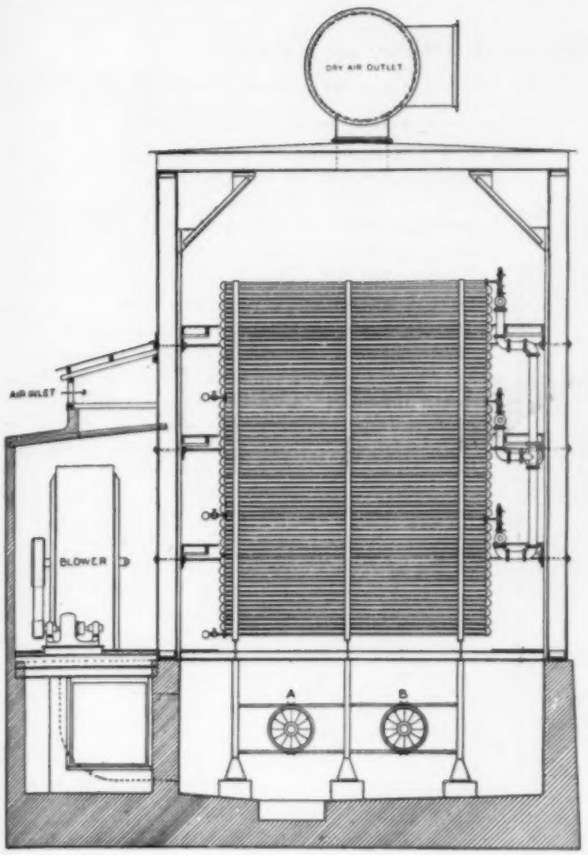


FIG. 4.—REFRIGERATING CHAMBER.

are as follows: Diameter high pressure steam cylinder, 28½ in.; low pressure, 56 in.; compressor cylinder, 22½ in.; stroke, 36 in. Two compressors were installed in order to have one in reserve at all times, as a furnace operating on uniformly dry air cannot be subjected to ordinary atmospheric conditions without serious results, and frequently on very humid days the assistance of the second engine might be required. Each compressor has a capacity of 225 tons ice melting effect.

Fig. 5 shows the brine tank, in which are twenty coils of pipe of the dimensions shown in the diagram. The coils are covered with calcium chloride brine having a sp. gr. of 1.21. The return brine from the refrigerating chamber flows into the top of the tank, is cooled by the ammonia expanding between the outer and inner pipes, withdrawn therefrom by a pump and forced back through the pipe marked "brine inlet" into the 2-in. or inner pipes, where it is cooled below the freezing point, and thence into the coils in the refrigerating chamber. The ammonia enters at the bottom of the pipes, thus traveling in the opposite direction from the brine, and by expanding between the 2-in. and 3-in. pipe cools the brine both in the tank and in the inner pipes. Forty thousand gallons of brine are required in the system.

In Figs. 3 and 4 is shown the arrangement of pipes in the refrigerating chamber. There are in each vertical line of coils seventy-five 2-in. pipes 20 ft. long, and in the chamber there are 60 vertical lines of coil, the whole representing 90,000 lineal feet of 2-in. pipe in the chamber. The pipes in each vertical coil are placed in staggered position to insure better contact with the air. The series of coils is divided into three sections and fed through a 4-in. header, and discharges into a 6-in. header, thence into a standpipe, from which the brine flows to the brine tank, its feed being arranged to cause the brine to flow in a direction opposite to that of the air. As the space between the pipes would become gradually reduced through the accumulation of frost, which might diminish the efficiency of the blowing engine, a blower was installed to force air into the refrigerating chamber, and in order to secure a uniform distribution of air over the coils revolving electric fans (marked 1 and 2) were placed in the space underneath, so that all of the coils would frost alike. The entering air, according to its humidity, deposits the moisture in the form of water or frost on the lower pipes and as frost only on the upper pipes, and passes from the top of the chamber to the blowing engines at a temperature of freez-

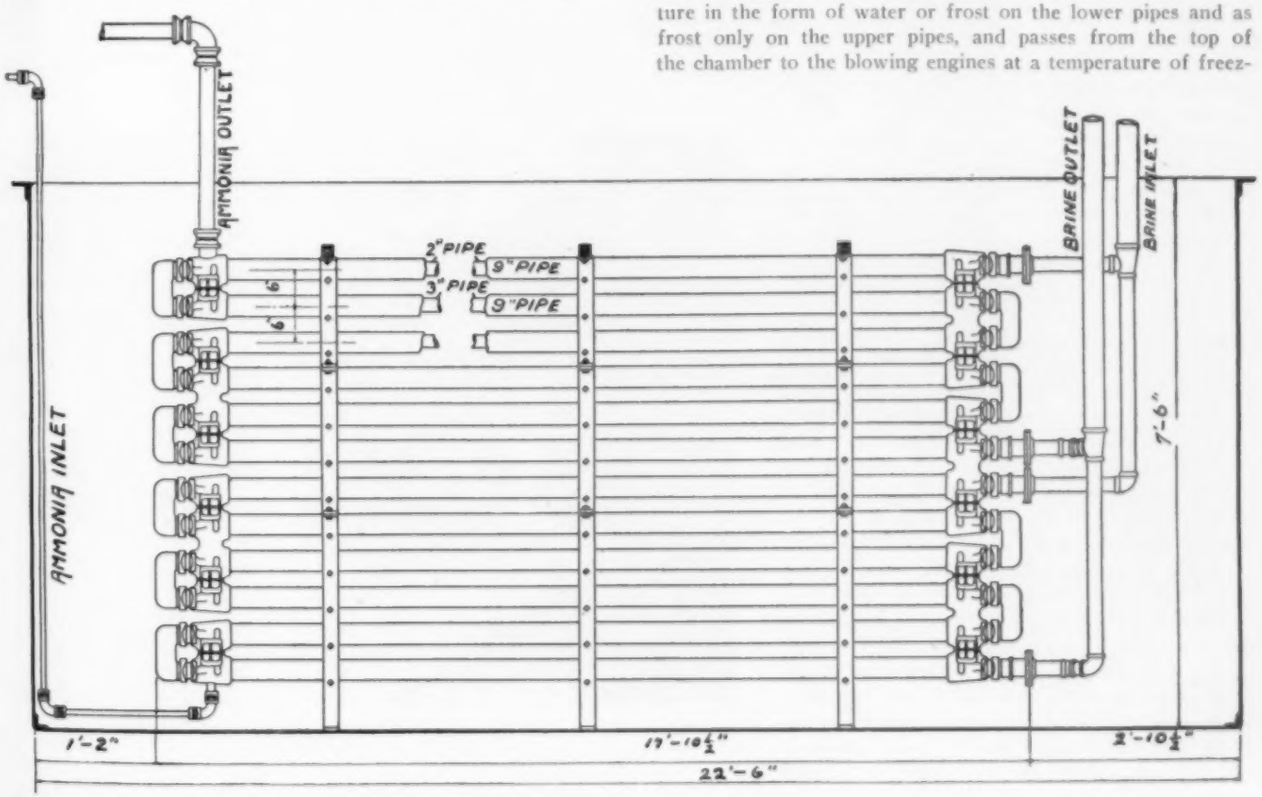


FIG. 5.—BRINE COIL.

ing or below and with a practically uniform content of moisture. When the pipes become covered with frost the cold brine is shut off from several vertical lines of coil at a time, and through an auxiliary pump and line of pipe brine that has been heated in a tank with steam is forced through, and in

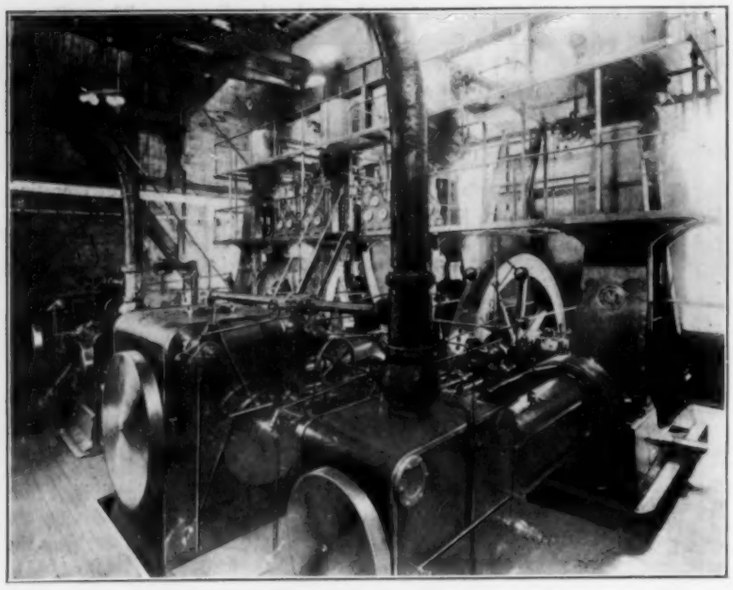


FIG. 6.—AMMONIA COMPRESSORS.

a few minutes the frost is melted. Connection is then made with the cold brine system, and frost begins to deposit quickly. The frost which has been melted off the pipes collects in a trough in the basement floor, from which it flows into the supply tank for the condenser.

The dry blast plant is constructed throughout in the most substantial manner, for it is obvious that an apparatus treating such an important element of the process as the atmosphere could not be practically applied to a modern furnace in an experimental way, but must of necessity be as ample in capacity and as substantial in construction as any of the present day accessories of the furnace stack.

The dry-blast plant was put in operation on Aug. 11, 1904. The furnace was making a grade of iron suitable for the basic open-hearth furnace, containing less than 1 percent silicon, with an ore mixture consisting of 50 percent Mesabi ore, the balance being soft hematites from Michigan. The mixture showed a yield by analysis of 53.5 percent iron. The coke used was shipped from two mines and contained on an average 10.5 percent and 12.5 percent of ash respectively, and also varied considerably in ash. In order to obtain correct data from the use of the dry-blast, it was determined beforehand that no changes in any particular were to be made in the operation of the furnace, other than the introduction of dry air, and this has been rigidly adhered to. In the data following a comparison is made between the operations of the furnace using dry air after Aug. 11 and those from Aug. 1 to 11 when the furnace was using the atmosphere under ordinary conditions. A comparison with the previous month would show a greater economy in coke, but since a change was made in the ore mixture in the latter part of July—which gave a lower coke consumption per ton of iron—a comparison of data when using dry air with that obtained in August prior to its use, and with the same ore mixture, would more accurately show the benefits derived. The burden on the furnace from Aug. 1 to 11, inclusive, was as follows:

Coke	10,200 pounds.
Ore	20,000 "
Stone	5,000 "

On Aug. 11 5 percent increase in burden was put on the furnace and later in the day 33 percent of dry-blast was used. As soon as this small quantity was introduced its effect was noticed by a brightening of the tuyeres and an increasing temperature of the cinder. After this change in burden had come to work and the condition of the furnace showing, if anything, more satisfactory, an additional 5 percent of burden was put on with confidence, feeling assured that an increased use of dry-blast would offset the increased duty on the furnace. From this period on the burden and volume of dry-blast were increased more slowly until, on Aug. 25, the furnace, using dry-blast entirely, had the following burden at work:

Coke	10,200 pounds.
Ore	24,000 "
Stone	6,000 "

thus in two weeks obtaining an increase in burden of 20 percent. The record of the furnace from Aug. 1 to 11, prior to the use of the dry-blast, and from Aug. 25 to Sept. 9 inclusive, using all dry-blast, is shown in Exhibit VII.

In Fig. 10 there is graphically set forth the record of furnace operations from Aug. 1 to Sept. 9, inclusive. This using dry air after Aug. 11 and those from Aug. 1 to 11, when the furnace was using the atmosphere under ordinary conditions. A comparison with the previous month would show the increase in output and reduction in coke consumption corresponding to the increase in burden. There is also shown the varying conditions of humidity from day to day, which represent the average humidity for each 12-hour period, and the change in humidity after being treated in the dry-blast apparatus. While the reduction in moisture and its increase in uniformity is considerable, it should not be lost sight of that this represents the beginning of operations, and there was still much to be learned with respect to manipulation of the dry-blast plant.

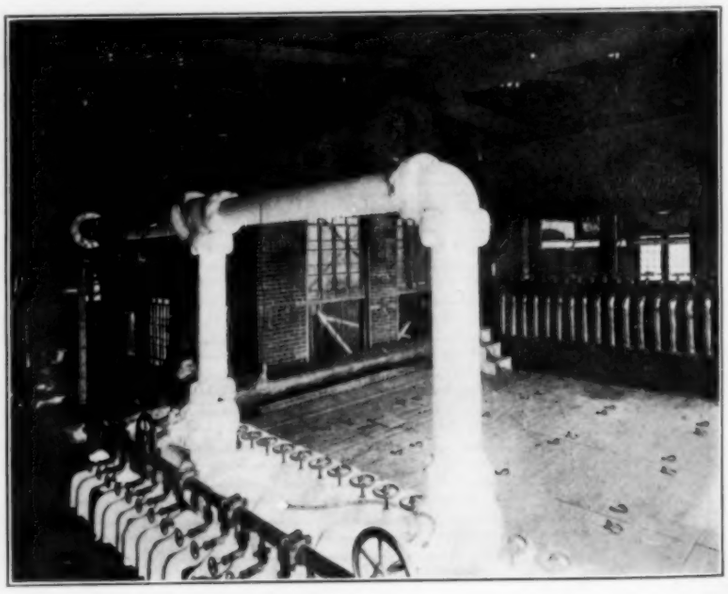
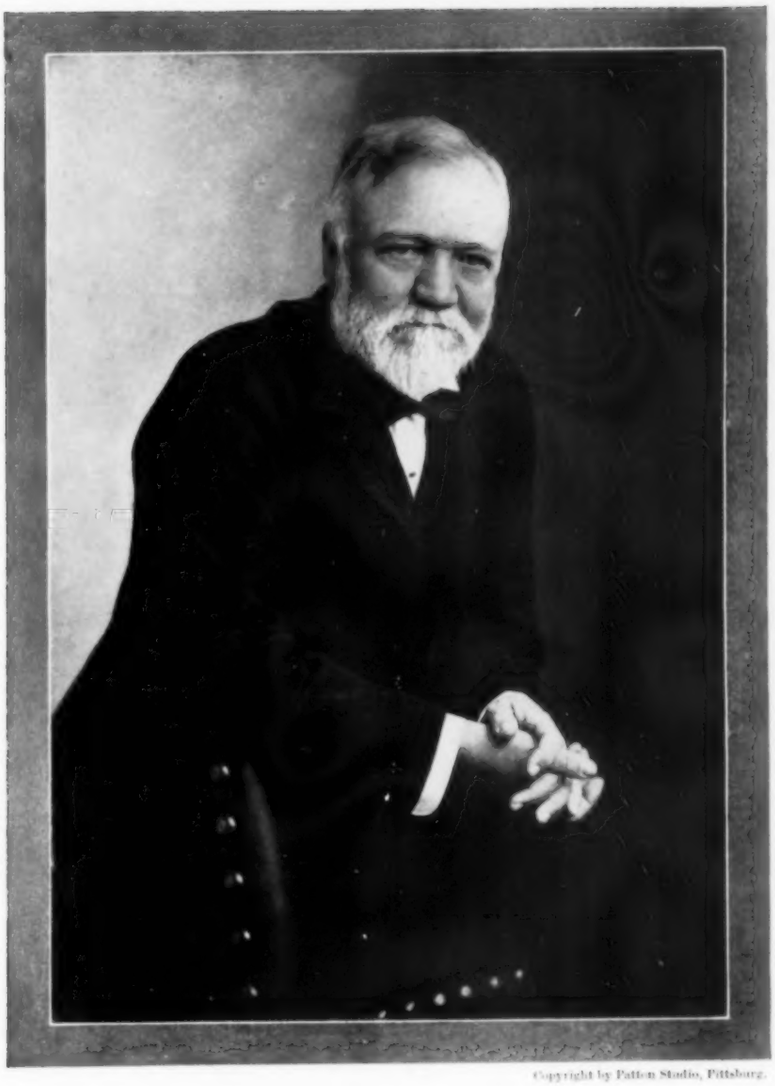


FIG. 7.—BRINE COOLING TANK.

The effect of reducing and making more uniform the moisture in the blast was clearly shown, when, during a period of excessive humidity extending over



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ANDREW CARNEGIE

18th President of the Iron and Steel Institute

SUPPLEMENT TO
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OCT. 27, 1904.

three days, a neighboring furnace charged during this period an extra quantity of coke and increased the quantity each day in order to maintain the grade of iron, while the Isabella furnace, operating on dry-blast, was in no wise affected.

On Sept. 10 it was found necessary to make some repairs to the compressors and to make connections to a new brine-header for thawing off the coils, and the burden was lightened accordingly. After these repairs had been made the burden was again increased, and from Sept. 17 to 30, inclusive, the furnace showed an average daily output of 452 tons, with a coke consumption of 1,729 pounds per ton of iron.

In order to show what changes have been made in the atmosphere by passing it through a refrigerating chamber, the following daily records of operations, as set forth in Exhibit VIII., will give a very clear idea.

During a period of thirteen days the average moisture in the atmosphere was 5.66 grains per cu. ft. and in the dry air 1.75 grains. Sixty-nine pounds of water were removed from the blast per ton of iron produced, which represents an average of 23,192 pounds (equivalent to 2,784 gallons) for the twenty-four hours. This weight was calculated from the volume of air blown into the furnace, as shown by piston displacement. For four days during the above period the water caught in the tank underneath the refrigerating chamber amounted to an average of 21,561 pounds (equivalent to 2,588 gallons) for the twenty-four hours, which is as close an agreement as could be expected, considering that the figures do not represent the same number of days, and the difficulty in accurately determining the volume and humidity of the air supplied in a given period. It is found sufficient in practice to thaw the frost off the pipes every three days. The coils are divided, for the purpose of thawing off, into three sections, each representing the same number of coils, and a section

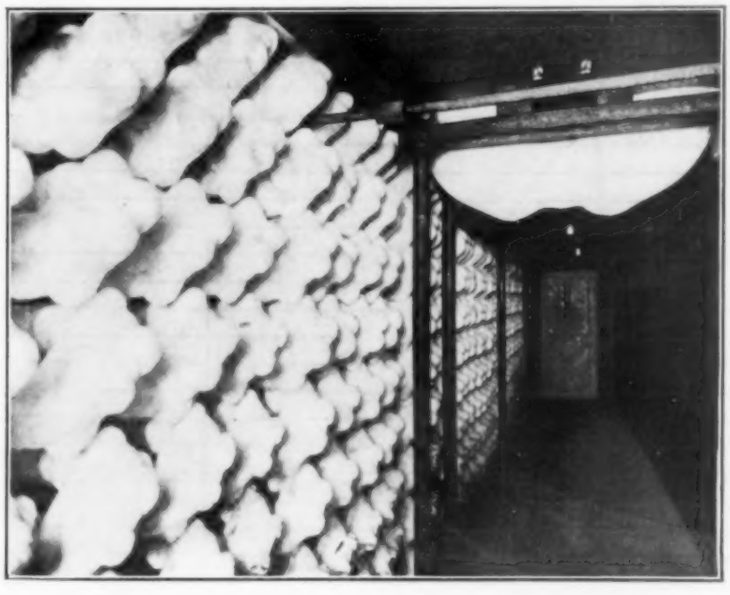


FIG. 9.—REFRIGERATING CHAMBER SHOWING FROSTED ENDS OF COILS.

is thawed each day, and in this way the work of refrigeration is not interfered with.

As the dry-blast was supplied to the furnace it became necessary to reduce the revolutions of the blowing engines, since the air supplied to the engines was lower in temperature than with the natural atmosphere and contained more oxygen per cu. ft., and the tendency of the furnace was to drive too fast. Before applying the dry-blast the engines were running

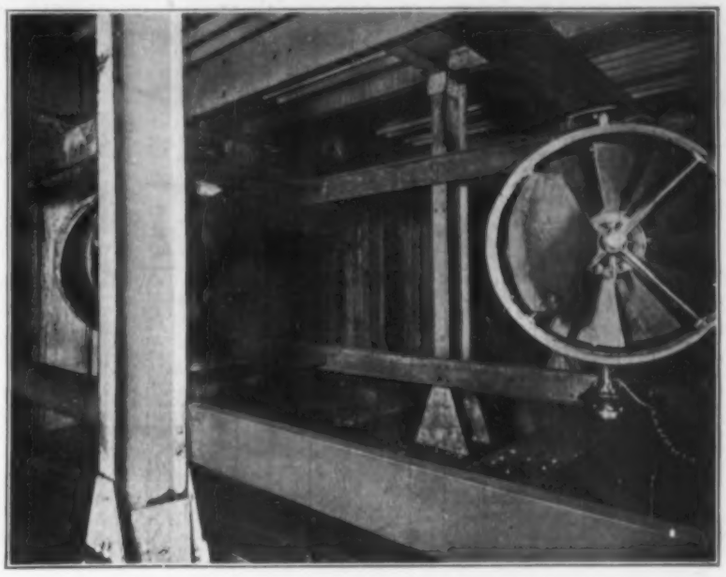


FIG. 8.—CIRCULATING FANS UNDER REFRIGERATING COILS.

at 114 revolutions and supplying 40,000 cu. ft. of air per minute; the revolutions were gradually reduced to 96, thereby reducing the volume of blast over 6,000 cu. ft. per minute and increasing the efficiency of the engines by 14 percent. With dried blast, 96 revolutions per minute of the blowing engines burned nearly 1 percent more coke and produced 89 tons more pig iron in 24 hours than 114 revolutions on natural air. The reduction in the revolutions resulted in a gain of 150 degrees in temperature of the blast, which even with this increase, through lack of area in the waste gas ports of the stove, did not average above 870 degrees.

The average analysis of the gas for ten days prior to the introduction of the dry blast showed CO, 22.3 percent; CO_2 13 percent, with an average temperature of 538 degrees. Later, with dry blast used entirely, the average analysis was CO, 19.9 percent; CO_2, 16 percent, with an average temperature of 376 degrees. This reduction in temperature of 162 degrees is a necessary consequence of the greater concentration of heat in the hearth by the dry blast combustion and the greater weight of burden heated by the gas, and represents an important saving of heat in the furnace.

The use of the dry blast has resulted in economies in several other directions. With the use of Mesabi ore, which is very fine in structure, the waste of ore dust through the escaping gases is quite large, and at many furnaces the waste in ore has become quite burdensome. The waste at the Isabella furnace before dry blast was used amounted to 5 percent of the ore charged; this has been reduced, though the greater uniformity in the furnace working, to less than 1 percent.

The saving in coke consumption reduces the phosphorus in the metal, and this, in making Bessemer iron, permits the use of higher phosphorus ores. As the Isabella furnace was making basic iron, it was of advantage to keep the silicon as low as possible,

provided the sulphur was kept low, and the absence of irregularities in the furnace operations resulting from the dry blast permitted the keeping of the silicon at a lower range without increasing the sulphur. It has been generally observed by furnace managers that when the silicon is lowered through increased humidity in the atmosphere, a leaking tuyere, or through other causes, the sulphur is rapidly increased; but it has been found in using the dry blast, that when the hearth temperature was suddenly lowered, principally from accretions on the bosh reaching the hearth, the sulphur did not increase, and in this respect the furnace has shown a remarkable uniformity in composition of the metal produced.

Exhibit VIII.—Refrigerating Chamber.

Time	Temperature		Grains of Water per Cu. Ft. Air		Temperature		Grains of Water per Cu. Ft. Air		Temperature		Grains of Water per Cu. Ft. Air	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
6 A. M....	68	21	5.19	1.33	70	22	6.35	1.70	77	22	3.94	1.48
7 A. M....	68	20	5.02	1.24	71	22	6.78	1.77	.....	.....	4.08	1.29
8 A. M....	70	20	5.56	1.55	69	22	6.67	1.62	.....	.....	4.22	1.42
9 A. M....	73	20	5.37	1.46	73	22	6.78	1.70	71	25	4.85	1.36
10 A. M....	74	20	5.47	1.81	74	22	6.78	1.70	.....	.....	5.02	1.48
11 A. M....	77	20	5.56	1.53	77	23	6.67	1.70	.....	.....	5.19	1.55
12 M.....	77	21	6.04	1.53	81	23	6.56	1.62	81	28	5.37	1.70
1 P. M....	80	21	6.04	1.42	78	24	6.56	1.70	.....	.....	4.85	1 62
2 P. M....	81	22	6.14	1.60	82	25	6.56	1.90	.....	.....	4.85	1.62
3 P. M....	81	23	5.74	1.60	81	24	6.19	1.74	84	29	5.02	1.70
4 P. M....	82	23	5.74	1.55	81	24	6.19	1.42	....	....	4.68	1.48
5 P. M....	82	22	6.04	1.62	80	24	6.14	1.48	.....	.....	4.85	1.60
6 P. M....	81	23	5.94	1.55	75	24	5.56	1.55	78	29	5.37	1.77
7 P. M....	80	23	5.74	1.62	72	24	5.94	1.70	.....	.....	5.37	1.62
8 P. M....	79	24	5.94	1.55	70	23	5.19	1.62	.....	.....	5.56	1.70
9 P. M....	73	23	7.01	1.85	69	22	5.19	1.42	72	29	5.74	1.70
10 P. M....	73	22	6.78	1.70	68	21	5.19	1.55	.....	.....	5.74	1.77
11 P. M....	73	23	6.78	1.70	66	20	3.94	1.77	...	.....	5 74	1.62
12 NIGHT	73	23	7.01	1.70	62	20	3.54	1.62	66	28	5 56	1.70
1 A. M....	73	23	6.78	1.70	59	18	3.41	1.42	...	.....	4.85	1.70
2 A. M....	74	23	7.01	1.70	57	17	3.54	1.13	.....	.....	5.37	1.70
3 A. M....	73	23	6.78	1.70	56	16	3.18	1.13	64	27	5.19	1 48
4 A. M....	73	23	6.78	1.48	56	16	3.18	0.99	.....	....	5.19	1.36
5 A. M....	73	23	6.78	1.48	53	14	2.85	1.06	.....	...	4.85	1.48

Mention has been made of the saving effected in the blowing engine through a reduction in the number of the revolutions, and this saving has an important bearing on the expenditure for power in operating the machines in the dry-blast plant. Prior to the use of the dry-blast plant, the blowing engines were indicated and the average h. p. developed by each engine was 900 i. h. p. From the cards taken when the furnace was supplied with dry blast, the average i. h. p. was 671, a difference of 229 h. p. per engine, which aggregates 687 i. h. p. for the three engines. Cards were also taken from the ammonia compressors, the compression and back pressure being kept as nearly as possible to the best working condition. When running at 45 revolutions, which would probably represent the average for the year, each engine developed 230 i h. p., or 460 h. p., for the two engines; the fans, together with the brine and water pumps, are well covered by allowing for them 75 h. p., making a total of 535 h. p. Comparing this with the power saved in the blowing engine room, there appears an excess above that required for operating the dry-blast plant. These figures, however, may not represent accurately the difference in power consumption, as the blowing engines were indicated at different times and the first test was taken with a blast pressure on the furnace of 17 pounds, while the test made with the dry blast was 15 pounds, and the figures given above might require some modification, as the effect of dry blast on blast pressure is not yet fully determined. The increase of uniformity in the working of the furnace, which is obtained through the dry blast, would result in a decrease in the blast pressure and it would appear in any event that the saving in power consumption in the blowing engine room would nearly or quite compensate for the requirements at the dry blast plant.

The application of the dry blast to the blast furnace has shown, in addition to the economies effected, that the furnace can be operated with precision; it works with greater regularity, and in consequence the product is uniform with respect to grade and composition, which makes the dry blast of particular value in the making of foundry iron, which is marketed by grade. An increase or decrease in blast temperature has a definite effect and can be relied on to accomplish the desired result.

The dry blast plant since it was started on Aug. 11 has been in regular operation. It started without a hitch and no difficulties have developed in any direction. Some modification in construction has been indicated as the result of the operation of the plant which would further reduce the moisture and add to its uniformity, but so far the changes suggested have been slight.

While the application of the dry blast to the blast furnace

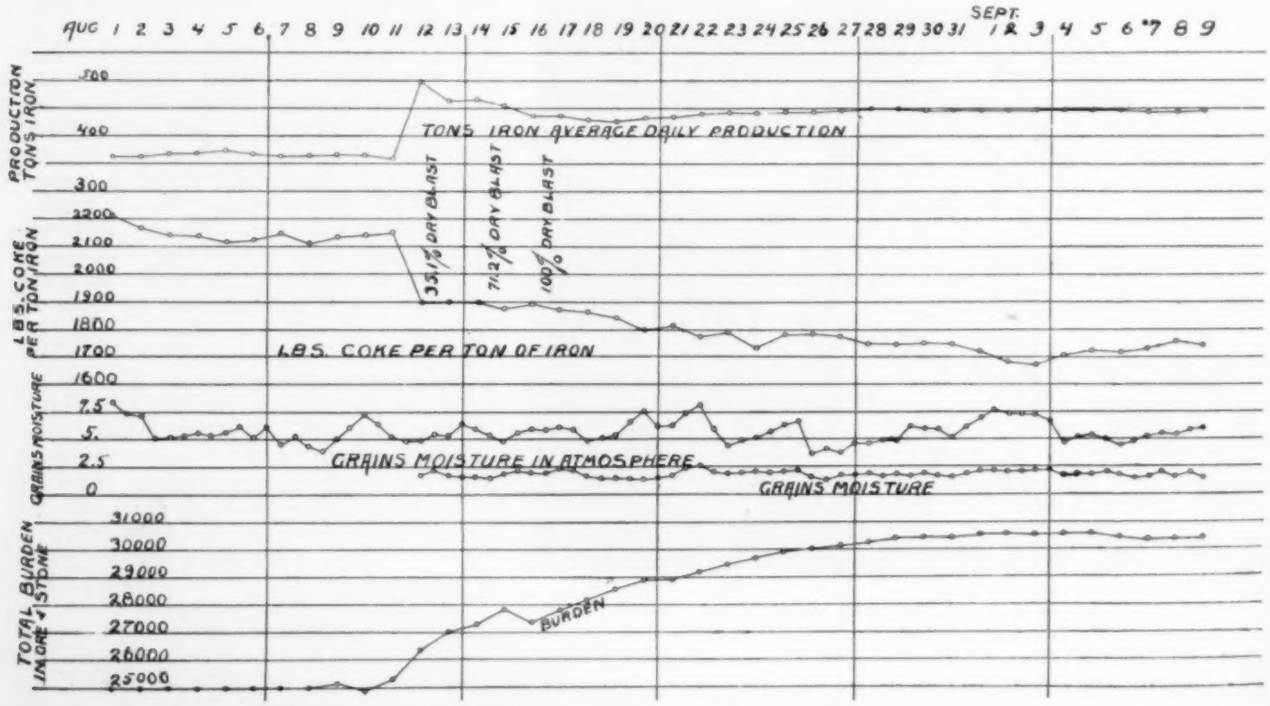


FIG. 10.

has effected various economies and produced a more uniform metal, its further application to the Bessemer converter would no doubt result in great benefits, since air is used in large quantities and the varying humidity affects the temperature of the charge and in consequence the quality of the steel. The metal from the metal mixer is remarkably uniform and additional uniformity secured through the use of dry air would be of further advantage. It happens that a higher silicon is required in the summer months to maintain the temperature of the blow, in which period it is also more expensive to maintain the right amount of silicon in the pig iron. With the use of the dry blast in the converter the proper temperature could be secured with a lower silicon in the metal, and this in turn would further reduce the coke consumption at the furnaces. In other processes where air is used in large quantities—particularly in smelters and copper converters and in the open-hearth furnace and in cupolas—it would appear that the use of dry air would effect important economies.

Purchase of Coal Lands.

The Alabama Steel & Wire Co., Birmingham, Ala., after several weeks of negotiation, has purchased the properties of the Underwood Coal Co., at Altoona, Blount county, Ala. The consideration was about $300,000. The Alabama Steel & Wire Co. is largely owned by George H. and E. T. Schuler, who have been anxious for some time to secure the Altoona property. The daily output of the Underwood Coal Co. is about 500 tons. The coal is of superior quality both for steam, gas, and coking purposes. The properties of the Alabama Steel & Wire Co. include the Virginia mines, near Bessemer; the rod and nail mill at Ensley; the steel mill and furnace at Gadsden, the ore mines and now the mines of the Underwood Coal Co. at Altoona. The company gets a freight rate from Altoona to Gadsden of 12½ cents. It will also have a rate to the rod and nail mills at Ensley of 20 cents a ton. It is the purpose to ship half of the coal from Altoona to Gadsden to be used in the steel mill and the other half to Ensley to the rod and nail mill. The Alabama company has ore property which carries about 50,000,000 tons that analyze 57 percent metallic ore. This property is located within 30 miles of the blast furnace. The company is also operating ore mines at Portersville, a short distance from Gadsden. At Virginia the company has 200 coke ovens in operation, which are supplying coke for its blast furnace. The company is entirely independent from all outside sources, and has everything necessary to operate with the exception of ordinary supplies. Its limestone quarry is located within six miles of its furnace.

The power plant for the new shops of the Mexican Central Railway Co., at Aguascalientes, Mexico, contains a Sturtevant induced draft apparatus consisting of two steel plate fans, each driven by a Sturtevant vertical engine. Each fan is capable of maintaining a draft pressure in the flue connection of each boiler equal to ¾ in. of water when handling all the gases of combustion burning 35,000 lb. of coal per hour with a flue temperature of 600 degrees F. The ring oiling fan bearings next to the fan are water-jacketed to prevent overheating. A counterbalanced sliding damper permits either fan to be cut off from the flues on both may be operated at the same time. The engines are provided with regulating valves which automatically control the steam pressure.

At the annual meeting of the Republic Iron & Steel Co. last week Charles F. Guthrie was elected a director to succeed E. N. Ohl, and directors Leonard C. Hanna, George A. Baird, P. L. Kimberley and A. W. Houston were re-elected.

The Hydraulic Press Co., Gilead, O., has purchased the old Ripple Foundry plant, which adjoins its property.

LAKE SUPERIOR IRON MINES.

Frank L. Coventry has taken the management of mines for the Canisteo Mining Co., of Duluth, and has located at the village of Bovey, Itasca county, Minn., near which the company's ore is found. The Canisteo Mining Co. is an organization formed less than a year ago for the purpose of developing lands that had been previously examined and explored by Messrs. C. A. Congdon and G. G. Hartley, of Duluth, located chiefly on the ore bearing formation through T 56 R 24, near the Mississippi river. This portion of the Mesabi has always been regarded with disfavor on account of the fact that its ores are not so clean as those of the easterly part of the region. It is probable that the process of ore concentration has not been carried so far on this portion of the Mesabi as further east. In the ore are seams of free sand and alumina, often of considerable thickness, that interfere materially with its iron content. Messrs. Congdon and Hartley reasoned that this sand could be washed out and have been conducting experiments along that line since they found enough ore there to warrant the expenditure. Their experiments are not the first, however, for two years ago the Standard Mining Co., of which W. P. Snyder was president and W. A. Barrows Jr., manager, secured an option for purchase on what was known as the Arcturus property, in section 13 56-24, and conducted some rather costly operations. This company was able to remove the sand and to secure a magnificent grade of hard, granular ore, quite free from phosphorus, but at that time the iron market got into bad condition. The Canisteo Mining Co. was reorganized shortly after the Standard ceased operations, to take over lands that Messrs. Hartley and Congdon had been at work on for some time. Explorations on these lands disclosed the fact that large tonnage of lead ore exists there, though not so great in comparison with what has been found in other more easterly townships as would be imagined from some reports that have got out. In all the company now has measured up about 25,000,000 tons of ore that is merchantable as it lies in the ground and 100,000,000 tons of an ore that will have to be concentrated 25 to 35 percent before it can be classed as salable, now or at any time within reasonable probability. It is probable that this tonnage will be increased as explorations continue, though but little work is under way outside of a definitely limited area in 56-24.

Explorations that have been under way for some time with the view of washing these ores to a higher iron content and a lower phosphorus have been promising and will be pushed with vigor from now on. This is the largest tonnage of unsold ore on the Mesabi range, and if it can be successfully and economically washed, will be of great value and importance. So far the experiments seem to show that washing will not be a serious or expensive task.

Other lands in the same part of the range present the same problem, and the bulk of holdings of probable value there are in the hands of heavy companies, such as the Canisteo, the Oliver and the Great Northern roads. These latter companies are doing no exploration at this time, but have been at work on options and will probably soon close for what they have found desirable.

Shop improvement can be too long delayed waiting for a convenient season. There are a few men like the manager whose comment on the blowing up of the boiler is said to have been: "Now we can put in that new skylight we have been needing so long."

S. Everett Sproul, manager of the Seaboard Steel Casting Co., and Richard Peters Jr., secretary of the Solid Steel Casting Co., have been appointed appraisers for the Delaware River Steel Casting Co., which is in the hands of receivers.

Some of the Significant Features of American Rolling Mill Practice.

By D. F. NISBET.

Considered in its generic significance what is termed American rolling mill practice includes nearly every conceivable method for the handling and mechanical treatment of iron and steel, as it comprehends within its limitations the apparatus and the usages in all American mills, of which there are all sorts and conditions.

We have mills in which the machinery is of an obsolete type, the mill practice archaic, and in which traditions still have a controlling influence. We have mills, also old, in which everything is kept in the best state of repair that is possible for mills of the type; mills built in more recent years, that when new represented the most advanced types

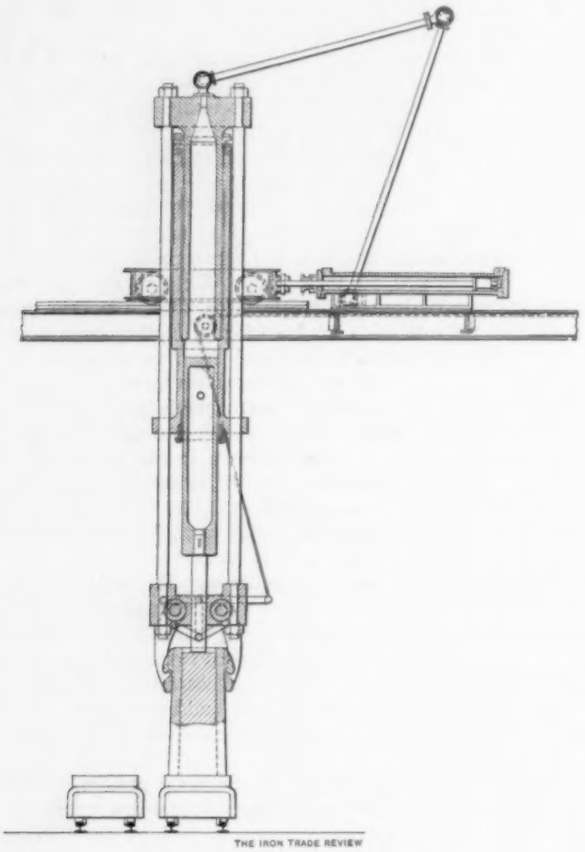


FIG. 1.—HYDRAULIC STRIPPER.

as to machinery and mill practice, but which, judged by present standards, are now somewhat behind the times. Nevertheless, many of these mills are able to exhibit cost sheets that compare favorably with those of more modern mills. We have also mills in which every effort is made to keep fully up to, if not a little ahead of, the best contemporary practice. In these mills no machine or appliance is permitted to continue in operation if a new one can be devised that will do more or better work, no matter what the physical condition of the old apparatus may be, or what its cost may have been, it is thrown out without hesitancy.

The great diversity in the constructive details and in the operative methods employed in our mills evidences the fact very clearly that there is no one type or any particular method that is typical of American rolling mill practice. In fact, the only feature that is typical of American practice is the diversity itself.

It is indicative, however, of the progressiveness of our mill owners and engineers and demonstrates that they have the "courage of their convictions," that they install such a variety of new and untried devices. And it is to the use of these special devices that the modern American mills owe their preeminence.

To differentiate and describe only those appurtenances and methods in use in American mills which are characteristically and distinctively American in conception or in employment, might be of some interest as a matter of history, or have some value as indicating the trend of American mill policies, but it would not be a coherent summary of those methods in vogue in American mills which collectively form what is termed American practice. And as a complete summary of American practice is too great an undertaking to permit of treatment within the limitations of a single article, only some of the significant features can be mentioned.

The Engineering of Mill Prospects.

There is probably no class of construction for industrial purposes, the design of which necessitates so frequent and extended incursions into the domains of all the co-related engineering lines, as that of the modern steel mill. Therefore, when a new mill project is under consideration the usual method of procedure is for the management to specify the character of the product and the tonnage desired, then turn the whole matter over to the specialist engineer, giving him practically a free rein as to the means to be employed. Of course, the value of a mill designed under this method will depend largely on the equipment and experience of the engineer employed. Since the engineer is not infallible, mistakes and errors are liable to occur and machinery or appliances to be installed which are not well suited for the work. Sometimes, also, machinery or devices may be installed, which, while successfully performing the specific operation are so intricate in their movements, or so complicated in their structure, and require so much attention and so frequent repairs, that it would have been better to have done the work by hand labor. This condition, however, will usually be found to result from the desire of the engineer to introduce some patentable feature that will inure to his personal glory and profit.

However, the existence of apparatus of dubious utility in the mill is sometimes due to the insistence of some official, who has, perhaps, absorbed just that little engineering knowledge that is dangerous, and who arbitrarily dictates that certain machinery shall be used, which perhaps, is ill adapted for the purpose, or insists that certain operations shall be performed by mechanical means which could be done better and cheaper by hand. Such interference, it is a pleasure to say, is exceptional, and it will usually be found that it is only exercised by officials, who either owe their positions to some influence other than fitness, or have a pecuniary interest in the apparatus they are pushing.

Steam Generation.

The economical generation of steam in boiler plants connected with rolling mills has been given but little consideration, particularly in those districts that are in proximity to the coal fields. In some other localities it seems to have merited attention, in a ratio that varied directly as the distance of the mill from the source of the coal supply.

The progressive mills in these outlying districts have for

years been using the most approved forms of water tube or Scotch marine boilers, in conjunction with economizers, stokers, coal and ash handling apparatus, and are in every way fully up to the average practice as regards economical steam generation.

It should be remembered that a gain in evaporation of one pound of water per pound of coal—for instance, an increase from eight to nine pounds, which is easily feasible as between certain old types of boiler still much used, and the modern water tube boiler—in a rolling mill boiler plant of 1,000-h. p. capacity, running 300 days per year, double turn, with coal at only $1 per net ton, means a saving of $1,500 annually. This, if capitalized, using the conservative investment factor of 15 percent would warrant the expenditure of $10,000 to accomplish; while the difference in cost of the installations of the given capacity, as between the two types of boilers, would not exceed $7,000. It is, therefore, difficult to comprehend why, in view of the possibilities for saving offered by the better class of boilers and boiler adjuncts, advantage has not been taken of them more extensively.

In more recent years, this matter of economical steam generation is receiving a consideration more in keeping with its importance, by progressive mill engineers, and it is hoped will soon cease to be a subject for criticism.

for the rolling mill service. Many of the more prominent American engine builders, when cognizant of the requirements of this service, with a characteristic perspicacity and promptitude, prepared themselves to meet the demand in a satisfactory manner. This fact illustrates in a conspicuous manner the progressiveness and acumen of American engine builders. Although they have standardized the manufacture of their engines to a remarkable degree, they have not hesitated in meeting a new demand, even when, by so doing, profits were somewhat reduced. The types of engines installed in modern American mills are about as follows:

For reversing blooming mills and slabbing mills the duplex, piston valve, link controlled engine is almost universally adopted, usually driving the mills through the media of gearing, with ratios varying from 1 to 1 to 1 to 2, 3 to 5 and 5 to 7 being quite common ratios. There are some engines that are direct connected to the mills and are found satisfactory; these, however, are largely in the minority.

Large three high mills, whether plate mills or finishing mills, are ordinarily driven by direct-connected automatic engines, while for medium and small mills, automatic engines are generally used, either direct-connected to the mill, or driving it through the media of belts or ropes.

The rope drive is becoming a favorite method for driving

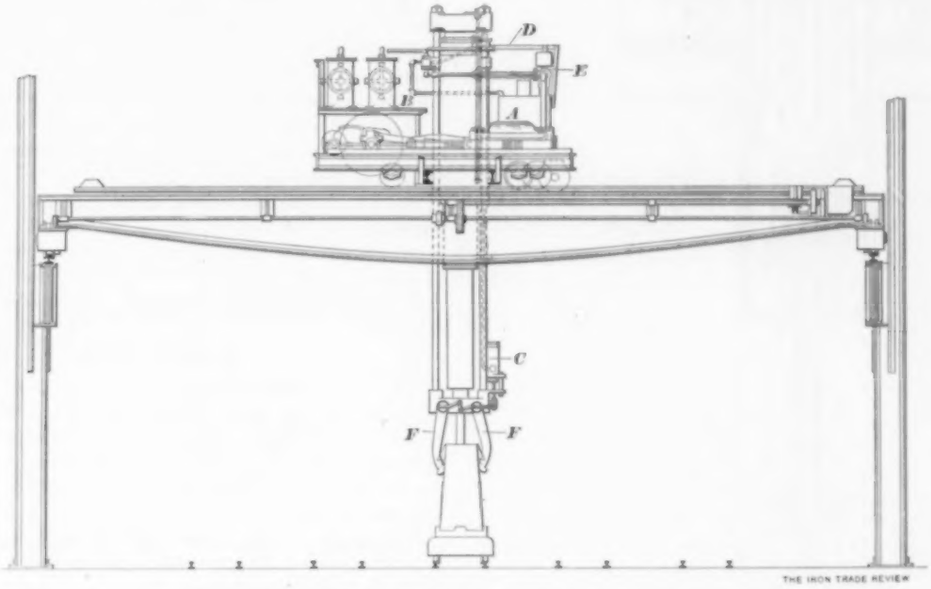


FIG. 2.—HYDRAULIC-ELECTRIC INGOT STRIPPER.

The present tendency is to concentrate the boiler power in one or more boiler houses, according to the size of the mill plant. The use of boilers over heating furnaces has practically been abandoned, because of the larger use of regenerative furnaces.

The pressures carried in the boilers for mills built during the past ten years range from 140 to 160 lb. per square inch.

Engines for Roll Trains.

The conditions of the service under which rolling mills are operated are the most severe to which any class of engines is subjected. Not only do they have to withstand the shocks incident to the work of rolling, which are severe in character and constantly recurring, but are exposed generally to the dust and grit that is ever present in the air of the mill, and to many other detrimental conditions. It is, therefore, imperative that the engine designed for this work, above all other physical considerations, should be massive and strong.

The necessity for these essential qualities is so well recognized that most engines recently installed in our mills are built from special patterns that have been prepared especially

small and medium sized mills. And the English system of using a number of independent ropes is given preference for the reason that if one or two or perhaps three ropes break, it will not cripple the mill seriously, whereas, with the American system of using one or two continuous ropes, the breakage or one rope is disastrous to the continued operation of the mill.

In the matter or economy in the use of steam in mill engines, in America as elsewhere, the general conditions imposed by mill service, together with the fluctuations in the times and intensities of the load, which in this service are of great frequency and magnitude, form a combination that utterly precludes attaining, or even approximating, the economy obtainable in other lines where engines are used.

The influence of these fluctuations in times and intensities of load may be better appreciated by instancing an American three high plate mill, rolling 300 plates per day of 22 hours running time, each plate requiring 15 passes to reduce it to the desired gauge. Since 300 plates are rolled in 22 hours, it follows that the elapsed time for each plate is 4.4 minutes; and as 15 passes are made in this time, if the

plates are of a size that requires the maximum power—which is a very ordinary condition—the engine power will fluctuate from the friction load to full load 15 times during the period of 4.4 minutes, or an average of one fluctuation in every 0.293 min., or 3.41 fluctuations per minute; making a total of 4,500 fluctuations in the 22 hours running time. And what is true of the plate mill is also true of all mills in proportion to these fluctuations. Hence it is obvious that with such frequent and violent fluctuations the measure of economy obtainable in other lines is impossible in rolling mill work. And it is also obvious that when considering the application of the compound engine to a roll train, the peculiarities of each particular case should be thoroughly studied before a decision is made.

Independent Condensers on Mill Engines.

American mill engineers have been severely criticised for their apparent neglect of the advantages of condensation in connection with rolling mill engines. This, however, is not

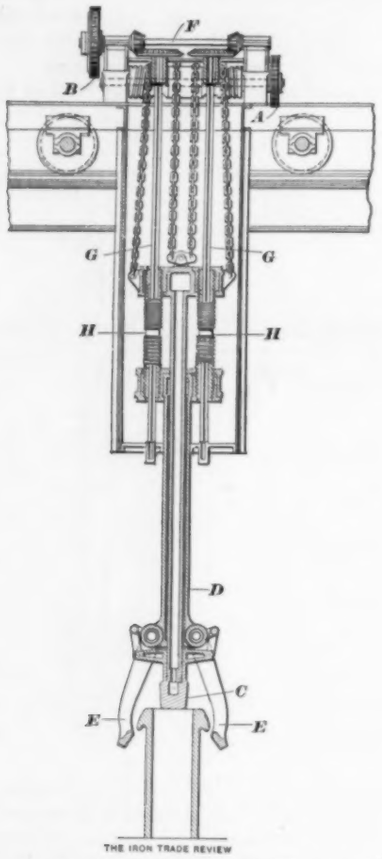


FIG. 3.—ELECTRIC STRIPPER.

because the value of the condenser in enhancing economy is not well understood. It is because of the knowledge that to secure real, and not merely apparent, economy, the condenser must be operated under certain favorable conditions. And few conditions under which it must operate in rolling mill service are favorable to its use.

The chief drawback is, perhaps, the excessive amount of injection water used per pound of steam condensed. It may be of interest to illustrate this phase, and use the plate mill heretofore mentioned as the "horrible example."

The average horsepower of the load runs of this mill and engine is approximately 966. The average steam per horsepower per hour for the load runs when condensing is 31.5 lb., and the total time occupied by the load runs is 1,458 hours. The average friction load of the engine and mill consumes 190 h. p., using 44.2 lb. of steam per horsepower per hour; and the total time occupied by the unloaded or friction runs is 20.542 hours.

We will assume that we shall require 20 pounds of injection water per pound of steam condensed, which, it will be conceded, is a very conservative estimate.

When using the independent condenser in connection with an engine running under variable load conditions, it is, of course, quite impossible to regulate the supply of injection water to correspond with the variations in the steam consumption constrained by the variable loads; nor is it feasible to compromise, by adjusting the supply of injection water to an amount just sufficient for condensing the average volume of steam used. The amount of injection water supplied must be gauged to that quantity which is sufficient for condensing the average volume of steam used during the times of load. This amount has been found by experience to be the least that is safe.

It follows, then, that if we have a quantity of injection water equal to the demands of the average of the load runs, flowing through the condenser at all times, we shall use in 22 hours $966. \times 31.5 \times 20 \times 22 = 13{,}388{,}760.$ pounds of water. And the total steam consumption will be, for the same period, $966 \times 31.5 \times 1.458 + 190 \times 44.2 \times 20.542 = 216{,}867.2$ lb. Hence, the average amount of water per pound of steam condensed is $\frac{13{,}388{,}760}{216{,}867.2} = 61.73$ pounds, while the amount of injection water per pound of steam used in doing productive work is 224.02 lb. And it is obvious, also, that where such an excessive amount of water is used the heat remaining in the hot well is hardly worth considering.

These are some of the reasons why the application of the independent condenser to rolling mill engines is considered, at best, a debatable proposition. However, since the advent of central condensing plants, many mill engineers have taken advantage of the system, and as a rule are satisfied that the net result of their use is favorable. Just what net percentage of gain is realized when all the steam condensed and all the injection water used are accounted for, would be an interesting statement.

Hydraulic Systems.

For several years after the introduction of hydraulics as an adjunctive motive power in mechanical operations about steel works and rolling mills, 300 lb. per sq. in. was the adopted hydraulic pressure. Later on, the pressure was increased to 750 lb. and in some cases to 1,000 lb. per sq. in.; 750 lb. being quite common.

While there is no doubt that these higher pressures are more economical for operating apparatus for handling heavy weights, for lifting medium and light weights, and for operating the numerous devices which perform mechanical functions about the mill, they are not so suitable. It has been found in practice that in many instances it was necessary to make plungers unduly large in diameter in order to provide sufficient resistance in the plunger, when considering it as a column; and as these mechanical devices are not only numerous in American mills, but are in almost constant use, this enlargement of the plungers was productive of serious waste in the hydraulic system. The present tendency is to adopt 500 lb. per sq. in. as being better adapted to all requirements than either the lower or higher pressures.

The duplex, direct-acting type of hydraulic pressure pumping engine, either simple or tandem compound, is almost universally used for the hydraulic supply. This type of pumping engine, although notoriously inefficient, considered from a thermodynamical viewpoint, is so simple in construction, so accessible for quick repairs, so "tractable" as to regulation, and so prompt in responding to demands made upon it, that one can forgive its deficiencies in the matter of steam economy.

It is customary to install at least three pumps, each of a capacity that will admit of any two being used at an accelerated speed for furnishing the supply for the mill, when the third pump may be undergoing repairs. This practice of

using a number of small units instead of one of sufficient capacity to supply the whole amount needed, is not, of course, conducive to economy, but it is conducive to the continuous operation of the mill, which, in this particular instance, is considered of greater importance.

Electrical Appliances.

During the past few years, electrically operated machinery and appliances have been introduced very extensively in American rolling mills, and generally have given excellent satisfaction. There is now a tendency to overdo the matter and use electric motors in situations where steam or hydraulic motors would be preferable. Such tendencies, however, especially where the field is in the developmental stage, are natural, and like the measles or whooping cough, must be permitted to run their course.

For operating carrier tables of the "straight away" type, i. e., tables in which the rollers run constantly, or practically so, in one direction only, as, for instance, in continuous mills, there is nothing better adapted for driving than the electric motor, and for tables in which the reversals are infrequent, they are also well adapted. But for tables which are undergoing frequent reversals, such as for blooming mills, slabbing mills, plate mills, finishing mills, etc., the small reversing engine is far better, and on the whole more economical, as the shocks occasioned by "plugging" the motor from full on forward to full on backward are not only detrimental to the motor, but are very destructive to the mill tables, and especially so to the gearing. The matter of more efficient control of motors in this service, is receiving the attention of electrical engineers, however, and there are some devices having this purpose in view, now being introduced, which, if successful, will eliminate, or at least mitigate the severity of the shocks incident to the present system of control.

Electrically operated traveling cranes are universally used in all the larger mills of recent construction, and are generally installed in older mills where the construction of the building will permit. These cranes are considered indispensable in mill service, for roll changing, loading and unloading cars, and the many other purposes that are constantly recurring about the plant.

Ingot Stripping.

The "ingot stripper" is now universally of the vertical type, operated by hydraulic pressure, electricity, or a combination of both, and supersedes the old style of horizontal "ingot extractor." The ingot stripper lifts or "strips" the mold from the ingot, leaving the ingot standing on the casting buggy, while with the older type of extractor the mold and enclosed ingot were laid horizontal and the ingot pushed out of the mold.

Fig. 1 shows the "Aiken hydraulic stripper, which is the type most used. These strippers are ordinarily used in pairs, and when the molds are removed from the ingot, they are placed on the empty buggy shown at the left. This type of stripper is so well known that an extended description of its mechanism and method of operation is unnecessary.

The operations of the hydraulic stripper are necessarily confined to a comparatively limited area, and as it is sometimes desirable to have a stripper which will cover a wider range, the stripper shown in Fig. 2 has been devised. This stripper will strip the ingots at any desired location within the crane runways, and by extending the crane runways to cover the mold yard it can be used for placing molds on the cars. The hydraulic cylinders of this stripper are similar in all respects to the stripper shown in Fig. 1, but instead of the pressure water being supplied from a stationary hydraulic plant, the pumps are carried on the carriage, and are operated by electric motors. The operator stands on the platform B, on which are located the electrical devices for controlling the movements of the apparatus.

The pumps force the water into the tank A, from which there is a pipe leading to the large cylinder. There is a hydraulic valve interposed between the tank and cylinders, within easy reach of the operator, which controls the movements of the stripping plungers. There is also a valve for controlling the plunger in the cylinder C, which operates the links F F, so that all operations and movements are under the control of the operator. These strippers are also of the duplex type.

Fig. 3 is a sectional view of one of a pair of electrically operated strippers. These are mounted on a carriage and bridge similar to the hydro-electric stripper shown in Fig. 2. Six motors are required for the complete operation of this machine; one for the bridge and five on the carriage, one of which is for traversing the carriage along the bridge. All motors can be controlled from a cage located at any convenient place on either the bridge or trolley. The motors are not shown in the figure.

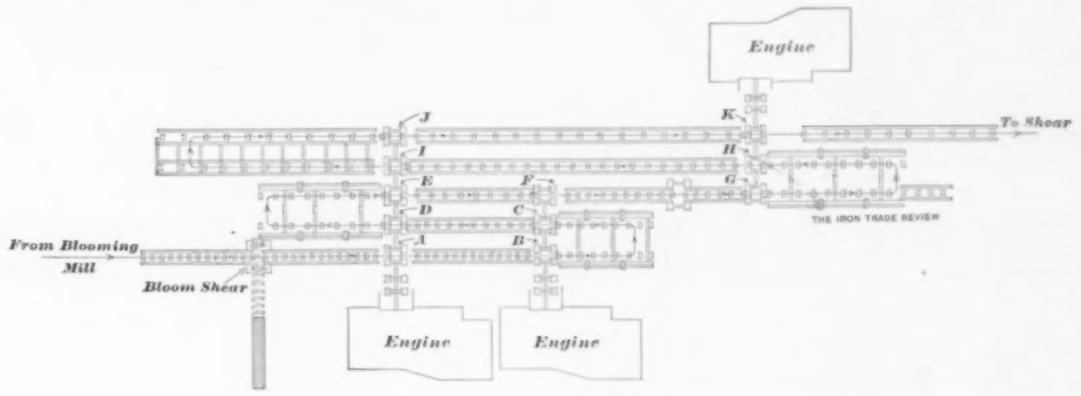


FIG. 4.—CLARK MILL.

When in operation, the motor controlling the drum through the gear A first drops the hold-down plunger C and lifting plunger D simultaneously until the hold-down strikes the top of the ingot, when a slight farther downward movement of the lifting plunger opens the links automatically. The motor driving the shaft F through the gear B is now put in motion, revolving the square shafts G G and the right and left screws H H, lifting the lower crosshead, to which is attached the lifting plunger D, which in turn strips the mold from the ingot.

Pit Furnaces.

The Gjers soaking pit has never found favor in American mills, and recourse has been had to the vertical gas-fired heating furnace. These furnaces have from one to five pits; those having only one pit of large dimensions usually use three or more covers, each operated by hydraulic cylinders, so that only a portion of the pit is exposed at a time. These furnaces will accommodate from 12 to 20 ingots, according

to size. The furnaces having from three to five pits have but a single cover to each pit, and each pit will hold about four ingots. The furnaces having the large single pit are somewhat more economical in the use of fuel than those having a number of separate pits.

Blooming Mills.

The two-high reversing blooming mill has been generally adopted in all recent American mills. Not, however, because it is deemed in any way superior to the three-high mill in productive capacity, but simply because it permits the rolling of the smaller sections to lengths which would be prohibitory where the lifting tables necessary with the three-high mill are used. For rail mills and other mills where the ingot is rolled into a 6 x 6 or larger bloom, and therefore comparatively short in length, the three-high type is still given preference.

When, instead of billets or blooms, slabs for skelp or plates are made on the blooming mill, the rolls usually have a blank space called the bull-head in the center of the roll, somewhat wider than the widest slab to be rolled, and on either side of this blank space grooves are provided for the most used sections.

The ingot is "broken down" on the bullhead until of a thickness that will permit of its being edged in one of the grooves, when the top roll is lifted and the piece turned up and edged. The usual limit in width that can be edged in this manner is from 22 to 26 in., therefore, it is obvious that slabs having a width slightly under the limit can have but little edge work, and those over the limit can have none; with the result of having poor edges on the rolled plate, necessitating a greater allowance for shearing on sheared plates, and the cutting out and scraping of such parts of the grooved plate as contain imperfect edges.

The sizes of American blooming mills range from 29 in. in diameter in small mills, porducing from 600 to 900 tons per 24 hours, to mills having 42-in. rolls, producing from 1,200 tons upward. The ultimate capacity of some of these larger mills has never been reached.

There is comparatively little in the practice at the two-high blooming mill that can be considered typically American.

Slabbing Mills.

Where the demand for slabs is of sufficient importance to justify it, the installation of a slabbing mill is made, as it is better adapted for this work than the blooming mill. The slabbing mill is simply a large and powerful universal mill, having usually but one pair of vertical rolls, and horizontal rolls with a bullhead in the center and grooves on either side, similar to the slab rolls used in the blooming mill. The vertical rolls can usually be brought near enough together to edge slabs 12 or 14 in. wide, and can be retracted until their outer surfaces clear the passes in the ends of the horizontal rolls. When the vertical rolls are in this extreme position the mill can be used as an ordinary blooming mill, for the production of blooms and billets. These mills can make any rectangular section from a 4 x 4 billet to a slab 36 to 48 in. wide by any desired thickness, and produce a large tonnage.

On account of the range of sections produced on this mill it is difficult to maintain the relative surface speeds of the horizontal and vertical rolls at any predetermined ratio. To overcome this difficulty, separate engines are used for driving and thus the relative speeds can be varied at will. [A good example of this type of mill is illustrated in another part of this issue.—EDITOR.]

Bloom Slab and Billet Shears.

The shear given preference for cutting the product of the blooming mill and slabbing mill into lengths suitable for use at the finishing mills, is the vertical hydraulic type, having the bottom knife movable and the top knife fixed; so that in cutting, the bloom or slab is lifted away from the table rollers. There are also shears for these purposes in which the top knife, instead of being fixed, is quickly adjustable to suit the thickness of the piece to be cut. This arrangement saves time and hydraulic pressure water.

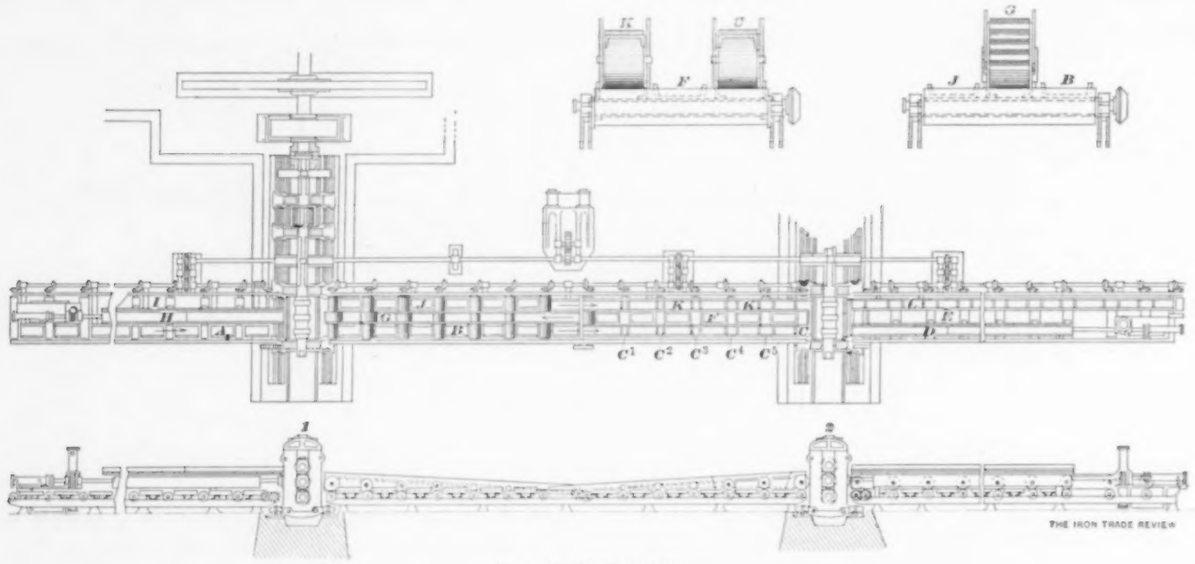


FIG. 5.—AIKEN MILL.

Plate Mills.

The three-high plate mill, with the top bottom rolls of a larger diameter than the middle roll, is practically the only type used in America. Sometimes, although rarely, a two-high, "hand over" roughing mill is used in conjunction with the three-high. These mills usually work slabs from the slabbing mill; but there are some mills that work direct from the ingot. The mills are invariably served with tilting tables, runout tables, cooling tables, shear tables, and frequently with supplementary transfer tables; so that when the plate arrives at the shear table it is cool enough for the "markers off," and no delay is experienced from the slab to the finished and sheared plate.

Universal Mills.

Universal mills are largely used in this country for the production of plates in widths from 12 to 40 in., and from ¼-in. to any desired thickness within reasonable limits. As a jobbing mill, it has no equal.

These mills are similar in general design to the slabbing, with the exceptions that they are smaller, and ordinarily have two pairs of vertical rolls. All rolls are driven by one reversing engine, when the mill is of the two-high type, which type includes by far the larger number. A few three-high universal mills have been installed, which are considered by the users quite satisfactory. It is doubtful, however, if the three high universal mill ever becomes popular, as naturally, the added parts tend to make the mechanism of the mill somewhat complicated.

Finishing Mills.

In probably 80 percent of the mills engaged in rolling iron and steel, the finishing mill is the principal manufacturing element, and the profitable operation of the plant depends largely on the capabilities of this mill for economical production. It is natural, therefore, that mill operators and mill engineers should give much thought to the problem of making this element of the mill as effective as possible.

The ideal finishing mill is that one which, for the least investment, will produce the greatest output at the smallest cost. And the items of cost should include not only the expense of superintendence, labor, fuel, etc., but also the usual fixed charges against the investment, such as interest, taxes, insurance, depreciation, repairs, etc. These latter items are frequently omitted from cost sheets; consequently, any statement of costs for mills, where such items are not included, may be very misleading.

The cardinal features of the ideal mill should be simplicity, strength, and accessibility throughout the mill, tables, and all appurtenances and appliances connected in any way with its operation. There should be an avoidance of all complex mechanism which would be liable to derangement or breakage at a crucial moment; and an entire absence of all complicated devices, which are intended to perform functions that vie with human volition, and which, because of their intricacy, are not susceptible of being constructed with proper regard for strength and endurance and a due appreciation of the character of the work entailed on machinery in rolling mill service.

In mill construction, as in other engineering structures, the strength of the whole is limited to the strength of the weakest part, and therefore, the ideal mill should be a composite structure embodying no weak or doubtful elements. At the present time, the mills most nearly fulfilling the conditions of the ideal mill are the American rod mills.

The American or three-high mill is the type almost universally used in this country. The two-high mill, whether "hand over" or reversing, has not even retained a foothold since the introduction of the three-high, and it is safe to say that it will never become a popular type. It has been installed in a very few instances for special classes of work for which it is well adapted, and, perhaps, could be installed to advantage for some other classes; but it cannot compete with the three-high, in any way, for general work.

The potentiality for production in the three-high mill—ordinarily comprising two stands of three-high rolls and one stand of two-high finishing rolls (usually called bullheads), if measured by the capacity at the bullheads, is enormous. But owing to the difficulty in keeping the finishing rolls full by following up closely, and the time lost in transferring the material from one stand of rolls to the next, full advantage cannot be taken of this potentiality. Moreover, few if any mills have furnace capacity or shearing facilities sufficient to handle such a production.

It is evident, then, since some of the difficulties are inherent in the type, that to derive fuller benefits from a rolling mill investment some mill other than the orthodox type must be considered.

Continuous Mills.

In the continuous mills we have the means for avoiding the difficulty in following up closely with the bars, and for eliminating the trouble and loss of time in transferring. But the continuous mill is only adaptable to certain classes of manufacture, and this limitation precludes its use for general purposes. Moreover, it has inherent faults of its own, which, for many purposes, render it wholly undesirable.

Some of the drawbacks to its use might be mentioned, such as the necessity of making the rolls of such diameters as will give quite exact speed ratios when driven at a predetermined number of revolutions, the multiplicity of gearing, the great first cost, and the large pecentage of engine power absorbed in overcoming the friction of so many rolls, pinions and gears, etc.

Where the work to be done is suitable, the disconnected or group type of continuous mill is, all things considered, the most desirable. These mills, instead of having all the rolls so placed that the speed ratios must be relative throughout the mill, are divided into groups or sections composed of three or more stands of rolls.

Each group is entirely independent of any other group, and at such distance from any other group that the bar is entirely free from the rolls when between any two sections.

The advantage of this arrangement is that it is necessary to make the speed ratios of the roll surfaces relative for the group only, and since each group is disassociated from any other group, all groups may have the same surface speeds, or the same speeds of revolution. With this system, all groups may be practically identical in construction.

A noteworthy mill of this type has been in operation in the mill of the National Tube Co., at McKeesport, Pa., for some 22 years. This mill consists of, first, a universal mill, then two sections of 12-in. rolls, all driven by one engine, and a stand of scarfing rolls driven by a separate engine. The universal mill has a pair of vertical rolls on either side of the horizontals, and is principally of use in rolling iron piles, to give edge work and gauge it to width.

The Clark Mill.

The Clark mill, shown in Fig. 4, was developed for the purpose of providing a mill which would produce the output of the continuous mill, but on which any section could be rolled. As before stated, certain sections are impracticable for the continuous mill, as for instance, heavy sections which would have to be turned between passes, and sections, in the rolling of which, unequal percentages of reduction in consecutive passes are unavoidable because of the shape. In the Clark mill, however, none of these limitations obtain.

This mill, as shown, comprises eleven stands of two-high rolls and three stands of three-high pinions, all driven by three engines. The roll housings are all three-high. The operation of the mill is as follows: The rolled ingot comes from the blooming mill without reheating, and is cut into suitable lengths by the bloom shear. The first bloom passes along the table through the bottom and middle rolls of A and B, is transferred mechanically to the next stand, then through the middle and top rolls of C and D; thence by mechanical transfer to and through E, F, and G, middle and bottom; to H and I, middle and top; to J and K, middle and bottom; then to shears or saws. The blooms follow each other in quick succession, and after the mill is once adjusted for a given section a large production can be made.

The most serious drawbacks to this type of mill are the large cost of the installation, and great length of tables to keep in repair; there being about 900 ft. of tables in an installation rolling bars 100 ft. long.

The Aiken Mill.

The Aiken mill, Fig. 5, although designed for a bar mill, is capable of handling a variety of work. This mill comprises two stands of three-high rolls, and one stand of two-high bullheads (not shown) set tandem at some distance apart, each stand being driven by a separate engine. The distinctive feature of this mill is the method and means em-

ployed for mechanically transferring the bar transversely from one line of passes to the next line.

The piece enters the mill from the table A, and passing between the lower and middle rolls of stand No. 1, passes along the level table B until it reaches the roller C^1. The rollers C^1 C^2 C^3 C^4 C^5 and C^6 are successively of increased diameter, so that their top surfaces present an inclined plane leading to the pass between the middle and top rolls of stand No. 2. Passing between these rolls the piece is carried by table D. This table is hinged at its outer edge and is operated by the vertical hydraulic cylinder shown near the right extremity of the table, the cylinder being controlled from a "pulpit." The bar is dropped by the table D down upon the level table E, thence between the middle and lower rolls, to the level table F, up the inclined table G, through upper pass in stand No. 1 to the table H, which is similar to table D, down to level table I, through bottom pass in No. 1, along level table J to inclined table K, through upper pass in No. 2, then over high table L to the bullheads. This mill requires but few men to operate, and has an excellent record for capacity and economical production.

There are several other types of mills which might be of interest, but enough has been written to show that the limitations of the orthodox type of mill are recognized, and that efforts are being made to find a mill as suitable for all classes of work, but which does not possess the inherent drawbacks of the ordinary types.

National Founders' Association.

As already noted in these columns, the next convention of the National Founders' Association will be held in Cincinnati, Nov. 16 and 17, at the Grand Hotel. A banquet will be held on the evening of the 16th, the arrangements for which are in the hands of a committee consisting of Messrs. William Gilbert, Buckeye Foundry Co., Cincinnati; J. D. Leary, Queen City Foundry Co., Cincinnati; W. D. Sayle, City Foundry Co., Cleveland; and Walter Russel, Russel Wheel & Foundry Co., Detroit.

Reduced rates of a fare and one-third for the round trip on the certificate plan have been granted by all the passenger associations exercising jurisdiction over the territory embraced in the membership of the association.

The general trend of opinion among the membership of the association would seem to portend an unusually large attendance. The fact that the association is now caring for interests of nineteen members in whose plants there are strikes, has tended to cement the entire membership, and the interest manifested on all sides is of a type seldom encountered in organizations of this character.

Furnaces are Resuming.

(Special Telegram.)

PITTSBURG, Pa., Oct. 26.—Two merchant furnaces and two steel works furnaces are preparing to resume and will be in operation within a week, making, with the Struthers furnace, an increase in the active capacity of five stacks.

The Standard Steel Car Co. has been awarded the contract for two hundred steel flat cars by the Panama Canal Commission. Price $855 each, delivered.

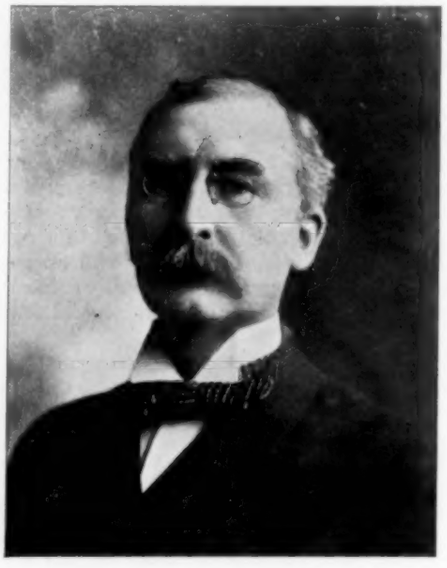
The Pennsylvania railroad's new steel car orders now aggregate 6,000. The Standard Steel Car Co. has received an order from the German-American Co. for 1,500 and 2,100 from the Erie railroad.

After having offered $22,500 for the plant of the Zanesville Iron Co., Zanesville, O., and having deposited $2,000 in cash as guarantee of good intentions, Messrs. F. M. Baumgarten and H. M. Trimble, of Pittsburg, and L. I. Bregman, of Cleveland, were prevented from closing the deal on account of objections of two creditors. It is expected that the plant will be offered for sale at an early date.

RESIGNATION OF DR. HULST.

The resignation of Dr. Nelson P. Hulst from the vice presidency of the Oliver Iron Mining Co. was announced at Duluth a few days ago. It takes effect Jan. 1 next. No announcement of his successor has been made and in line with the policy of the company, there will probably be no new men taken in, and his successor will come from the rank below.

Dr. Hulst is a familiar figure in Lake Superior development. He was the first scientific man to operate upon the Menominee range, in the early '70's, and he was virtually the discoverer of that range. He was president and manager of the Pewabic Mining Co., manager of the Menominee Mining Co., of the Interstate Mining Co., and other corporations that have had very much to do with the development of the region. Until the organization of the Oliver Iron Mining Co. in 1896, and its entry to the old ranges in the following year, his professional career was given chiefly to the Menominee, though he had important positions elsewhere. When the Oliver Co. became interested on the Gogebic, to which range it first turned its attention after taking the Mountain Iron, of the Mesabi, Dr. Hurst was made general manager. He held this position until the advent of the United States Steel Corporation, with all its minutia of detail



DR. NELSON P. HULST.

required that the management, as held before, should be divided among several, and that the most active labor should be in the hands of younger men. He became vice president, in especial charge of geology and explorations. In this responsible position he has remained. His offices were at Duluth, and most of his time was spent there, though his family never moved from Milwaukee, in view of his resignation at some period to be determined. That period has arrived, and the resignation was given last week.

Dr. Hulst is a man of the highest character and of engaging and genial personality. Unassuming in manner and disposition, he is liked by all with whom he comes in contact. No one can omit a personal tribute to him, and his resignation is deeply regretted.

The Kenwood Bridge Co., Chicago, Ill., has secured the contract for a 1,500 ft. viaduct at Alton, Ill., for the Alton & Granite City Electric Railway. The viaduct will have three 160 ft. steel spans and will require about 700 tons of steel. The same company has the contract for the Third avenue hotel at Cedar Rapids, Ia., requiring about 350 tons of steel.

SLABBING MILL OF THE LACKAWANNA STEEL CO.

The slabbing mill has become a firmly established factor in the modern steel mill for the preparation of slabs, and is a formidable competitor of the orthodox blooming mill for the preparation of blooms and billets also. In a mill designed for reducing the unwieldy ingot to slabs, blooms or billets of dimensions suitable for use at the finishing mill, the first essential is that it shall have the strength to withstand the strains imposed by the large reductions of section necessary to produce the tonnage demanded of modern mills. The second essential, which secures continuous effectiveness and to a large extent immunity from costly breakdowns, is massiveness of construction. When the metal is properly distributed, this carries with it also the first requisite.

Perhaps massiveness in construction has not been fully appreciated, some builders acting on the principle that if the mill has adequate strength to withstand safely the work of rolling, nothing further is essential. A mill lacking in massiveness may be likened to a steam hammer having an anvil block, the inertia of which is insufficient to absorb fully the impact of the blow delivered by the descending hammer. The unabsorbed portion of the blow is transmitted to the foundation, which in time is destroyed.

In the design of the slabbing mill illustrated herewith, this property of massiveness was aimed at throughout and a study of the drawings makes it more and more apparent that the "anvil principle" is a salient characteristic of the entire mill.

The primary reason for the existence of the slabbing mill is to provide a machine whereby slabs of various widths and thicknesses can be rolled direct from the ingot, without having recourse to turning the slabs up for the purpose of edging, an operation difficult with medium widths and impossible with very wide ones, without some special appliances for holding them in position while rolling the edges. And a slabbing mill that does not belie its name should be capable of reducing the width of an ingot, by use of the vertical rolls, at the same time it is being reduced in thickness by the horizontal rolls, thus making it feasible to produce, from a few standard sized ingots, slabs of any width or thickness, within reasonable limits. This feature of being able to use but few sizes of ingots simplifies the work in the converting department and obviates the necessity of carrying a large number of various shapes and sizes of ingot molds. Another advantage of the slabbing mill is, that by retracting the rolls to their extreme outward position, the horizontal rolls can be used, as in an ordinary blooming mill, for the production of blooms or billets.

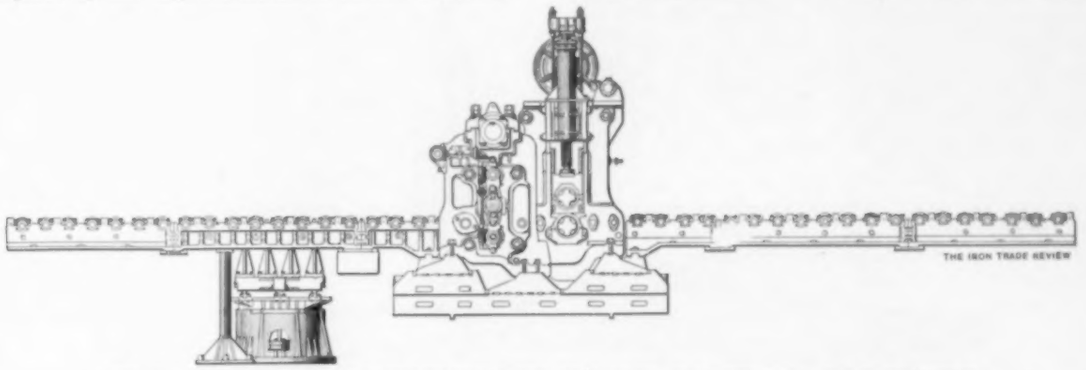


FIG. 1.—END ELEVATION OF LACKAWANNA STEEL CO.'S 32-IN. SLABBING MILL, SHOWING TABLES.

The illustration represents the 32-in. slabbing mill of the Lackawanna Steel Co., Buffalo, built by Mackintosh, Hemphill & Co., of Pittsburg. The mill is of the two-high reversing type, and is designed to roll ingots up to 54 in. wide and 30 in. thick.

The horizontal rolls are driven by a 46 x 60-in. two-cylinder reversing engine, through gears of 9-in. pitch and 40-in. face, the pair having a ratio of about 1 to 2¼.

The vertical rolls are driven by a 36 x 48-in. two-cylinder

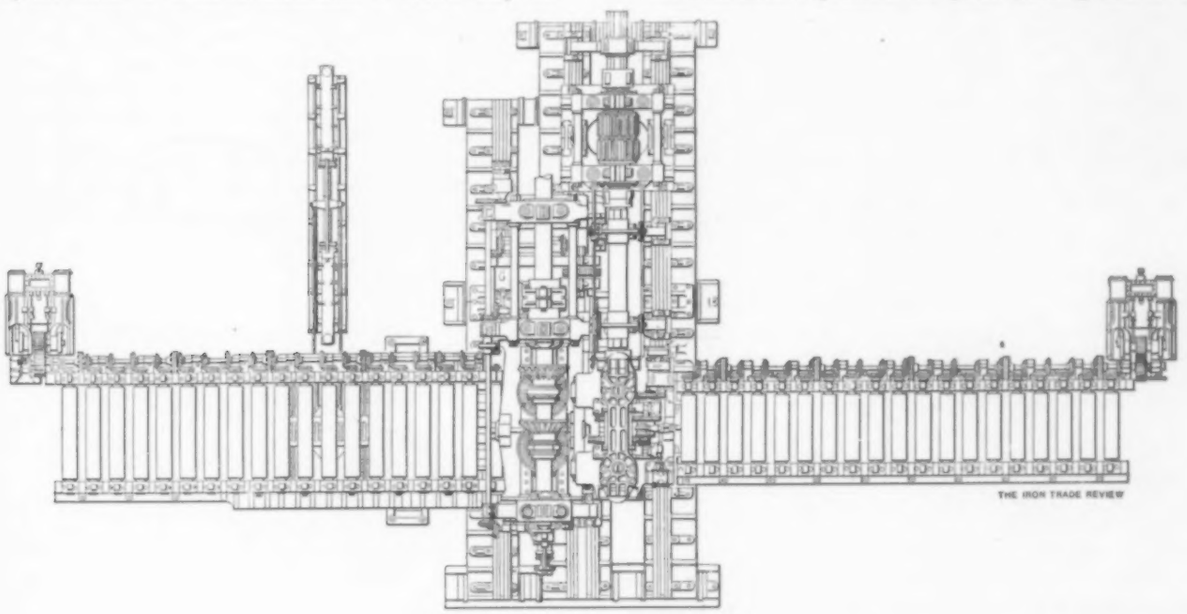


FIG. 2.—PLAN OF MILL AND TABLES.

reversing engine, through gears of 9 in. pitch and 30 in. face and have a ratio of about 1 to 1⅜.

Horizontal Rolls.

The horizontal rolls have a diameter of 32 in. and a length of barrel of 64 in., with necks 25 in. by 25 in. The wabblers have a diameter of 23 in., a total length of 20 in., of which 12 in. is the "pod." The top roll is balanced by the hydraulic cylinders shown in section in Figs. 3 and 7, being suspended by the rods A A which are attached to the roll carrier. These cylinders are also of use as a part of a quick roll changing device, which is patented and controlled by the makers of this mill. The operation of this device, briefly, is as follows:

The top roll is raised to its highest position by the cylinders and rods A A. These rods are provided with cotter ways, which, when the roll is in this highest position, come just above the top of the roll housings. Cotters are now placed in the cotter ways and the plungers lowered until the cotters rest on the tops of the housings and support the roll.

The plungers are now lowered a trifle more to permit the adjustment of the stirrups attached by the chain slings to the rods BB, under the ends of the rolls as shown in Fig. 7. The roll is then raised, freeing the rods AA, which can then be lifted out of the way and the carrier removed, leaving the riders in the housing if desired, there being a special provision for holding them in place, the cantilever beam of the carriage D can now be run under the roll, the roll lowered upon it, and removed through the window. The plungers can now be lowered, and the stirrups placed under the lower roll, and, raising to the proper height, taken out in the same manner. By reversing the order of the operation, new rolls can be placed in the mill. This arrangement provides an effective means for changing rolls quickly.

The screw down apparatus consists of screws 11 in. in diameter, operated by a 75-h. p. motor, through the media of alternative sets of gearing of different ratios, either of which can be used at will. This arrangement permits of using a slow motion, under absolute control, when screwing down, and a very rapid motion when retracting the screws. The device is controlled at the pulpit by simply throwing a lever, which governs the hydraulic cylinder operating a clutch.

Vertical Rolls.

The distinguishing characteristic of the slabbing mill, as to the constructional differences in the designs of various makers, usually lies in the treatment accorded to the problems comprehended in the use of vertical rolls. The most perplexing problem in this connection, the satisfactory solution of which is of vital importance to the effectiveness of the machine, is that of transmitting motion to the vertical rolls in such a manner as to insure a reasonable degree of immunity from costly replacements.

Many schemes have been devised and tried, but nothing has been found that is equal in simplicity and durability to beveled gearing, when the construction of the mill will admit of the use of gears proportioned for the work. In this mill three vertical rolls are used, one working roll being driven positively through the miter gears and the other working roll through frictional contact with a dummy roll, driven positively by the second pair of miter gears. The advantage of this seeming multiplication of parts, is, that it makes it possible to use gears of large diameter for transmitting power to the vertical rolls. In this particular case, where 18 in. has been specified as the minimum width of slab desired, miter gears having a pitch diameter of 57.45 in., a pitch of 7½ in., and a face of 20 in. are used. If but two rolls were used, other conditions being the same, gears having a pitch diameter of about 36½ in. are the largest that could be used. And since the life of a gear depends on the strength and wearing surface of the teeth, it follows that the larger gear is the safer and more economical.

With this arrangement of rolls, no trouble is experienced by reason of the rolls failing to "bite" the ingot or slab. The

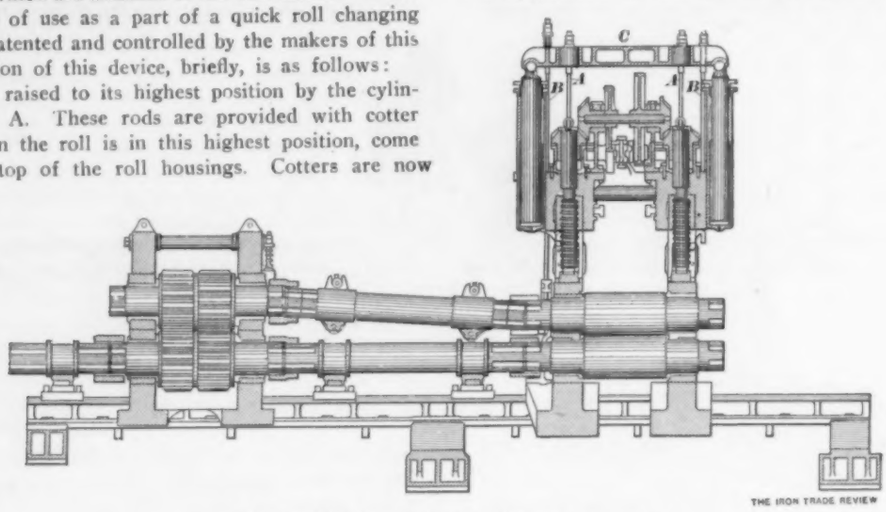


FIG. 3.—SECTION THROUGH HORIZONTAL MILL.

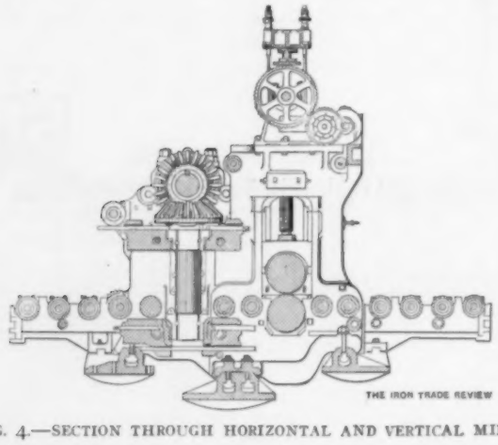


FIG. 4.—SECTION THROUGH HORIZONTAL AND VERTICAL MILLS.

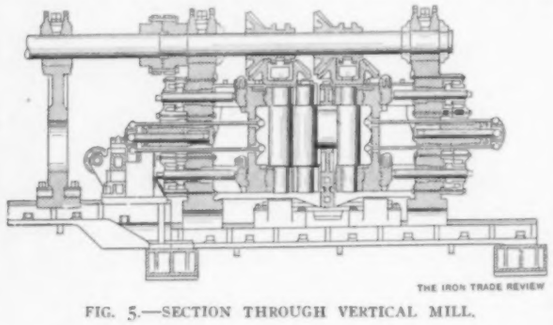


FIG. 5.—SECTION THROUGH VERTICAL MILL.

positively driven roll forces the piece against the other working roll, forcing it in turn against its driver, causing the piece to go through the rolls without slipping. This arrangement of rolls and method of driving is patented by the builders of this mill.

When, however, it is desired to roll slabs narrower than 18 in., the vertical rolls may be made somewhat larger, or the miter gears somewhat smaller, or both. The vertical rolls are 22 in. in diameter and have 14 x 24-in. necks.

Pinions, Driving Shaft and Tables.

The pinions are steel castings and contain 15 straight, staggered teeth, triple shrouded. The pitch diameter is 44 in., the pitch 9.147 in., and the face between shroudings 25½ in., making a total face of 51 in. The necks are 25 x 25 in. The horizontal shaft, which transmits motion to the vertical rolls, is 20 in. in diameter, and the section resting in the housings weigh 24,640 lb. In this mill the driving of the vertical rolls is through a single continuous shaft, substantially mounted in rigid bearings provided for it in the vertical roll housings, and the whole driving arrangement combines simplicity, durability and reliability.

The roller tables serving the mill are of the same substantial construction noticeable in the design of the mill. The rollers are all 18 in. in diameter. Those on the leading side are 8 ft. 11 in. long, while those on the delivery side are 6 ft. 7 in. long. The roller shaft is of forged steel, 8 in. in diameter, and the bearings are 7½ in. in diameter by 15 in. long. The side shaft is 6 in. in diameter and the roller miter gears are 18.21 in. pitch diameter, 19 teeth, 3 in. pitch, and 5 in. face, all steel castings. Each table is driven by separate reversing engines, each having 14 x 14 in. cylinders. They drive the

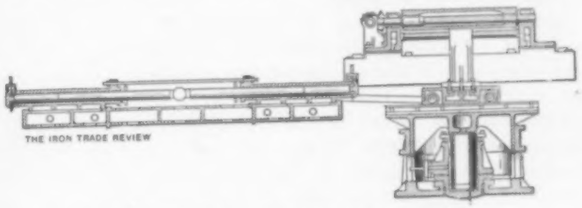


FIG. 6.—SECTION THROUGH MANIPULATORS.

6-in. side shaft through gears of 3½ in. pitch, and 12 in. face.

The leading table is served by a manipulator of the Mackintosh, Hemphill & Co. type, shown in elevation in Fig. 1, and in section in Fig. 6.

The impression of massiveness conveyed by an examination of the drawings will be confirmed by an inspection of the appended weights of some of the principal parts.

Weight of shoes	355,270 lb.
Weight of shoe girders	153,750 lb.
Weight of vertical roll housings	180,000 lb.
Weight of horizontal roll housings	254,000 lb.
Weight of pinion housings	140,000 lb.

The total weight of the mill, tables and engines, is 4,200,000 lb., or 2,100 net tons.

The business of James & Foote, makers of cut gears and special machinery, Chicago, has been purchased by the Foote Brothers' Gear & Machine Co., which has removed the plant to 24 South Clinton street, increasing the shop capacity about 50 percent by the installation of new machinery.

The Detroit Brass & Iron Novelty Co., Detroit, Mich., on Oct. 26 filed a voluntary assignment showing assets amounting to $18,873 and liabilities aggregating $13,013. Edwin H. Humphrey is named as assignee.

The Star Tank Co., Middlebury, Ind., will move early in November to the new plant recently purchased at Goshen, Ind.

NATIONAL ELECTRIC CO.'S PLANS.

The National Electric Co., of Milwaukee, has entered into an important arrangement with Robert Lundell and Robert T. Lozier, by which the Company will manufacture and market the motors and generators, and systems of operation and control that are covered by the latest inventions of Robert Lundell; the commercial direction of the undertaking being placed in the hands of Robert Lozier, (who will also act as general manager of the electrical sales department of the National Co.). Under this arrangement Mr. Lundell assumes the direct supervision of the engineering involved under the license that he grants the National Co. It might be said that this license covers all of Mr. Lundell's inventions not already under contract to other companies, and all inventions that he may hereafter make during the life of this license. These inventions of Mr. Lundell are of particular interest to the trade, in that they cover important developments in direct current apparatus. Some of these patents are for a new type of motor and dynamo frame construction, as well as a new method of commutation, by which a material gain is obtained in the space occupied by the apparatus, its efficiency, and the flexibility of its speed control and regulation.

As to the commercial significance of this new arrangement,

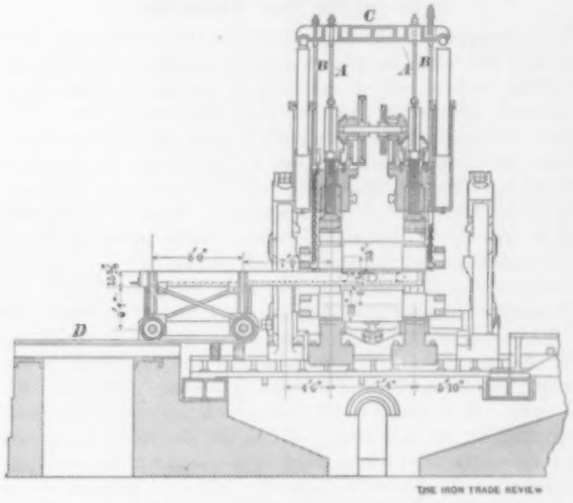


FIG. 7.—ARRANGEMENT OF SLABBING MILL, SHOWING ROLL-CHANGING BUGGY.

the field to which Mr. Lundell's inventions particularly apply is one of the broadest and best established in the business. It is a field with which Mr. Lozier had been associated from the earliest commercial development of the electric motor, he having been placed in the testing department of the Sprague factory when it was started in 1887, when the first commercial electric motors were developed, and has since followed the development of the business in all its phases. The National Electric Co., of Milwaukee, formerly operating under the style "Christensen Engineering Co." has in the past seven years equipped the majority of the electric cars using air brakes. Four years ago the present plant was built and equipped with the best tools and labor saving machinery. The foundry has open-hearth and crucible furnaces for making steel castings, cupolas for gray cast iron, and there is a complete brass foundry as well.

Success in the air brake business encouraged those financially back of the National Co. to enter into the general field of electrical machinery, and two years ago a competent engineering corps under the able direction of W. L. Waters, the chief engineer of the National Electric Co., and an active sales organization was put into operation, and the results of this work have in turn been so thoroughly success-

ful that the National Co. has now decided to follow up the material gain already made, with a view to developing this branch of their business to its fullest capacity, and to this end have established a separate electrical department. Mr. Lozier will be aided in directing the work of that department by his long experience in the electrical field Beginning with Edison early in '83 and running down through the engineering and commercial branches of the business for 13 years, with the General Electric Company; for the last eight years he has devoted his time to marketing the apparatus of the Bullock Electric Mfg. Co.

Samuel Watkins is the president of the National company. He organized it, and under his able direction the company has reached its present prominence. Bernard T. Becker, who represents the interests of those financially back of the company, and who is himself a large stockholder and a director, will act in an executive capacity. The first vice president and general manager of the National Electric Co., Frank C. Randall, is widely known throughout the electric street railway field and the air brake sales will continue as in the past under his direct charge. Of the operative force, R. P. Tell is the Secretary and Treasurer. Mr. J. H. Denton, well known to all those who come in contact with the Air Brake business, is General Superintendent.

Rules for Pig Iron Warrants.

The managers of the New York Produce Exchange have approved the rules to govern trading in pig iron warrants. The iron business will be initiated on the Exchange as soon as certain agreements with financial institutions have been signed and the rules formally posted. The pig iron committee of the Exchange, which has had charge of the matter, consists of J. F. Parker, chairman; J. J. D. Trenor, J. P. Truesdell, D. M. Van Vliet, J. J. Archer, J. E. Pope, C. C. Wheeler and G. H. Hull. Chairman Parker, when requested for a brief explanation of the new plan of trading said: "The idea in brief is that the American Pig Iron Storage Warrant Co. will issue their warrants for pig iron stored in their care by the manufacturers. These warrants are to be registered with the Central Trust Co. and may be deposited in the Farmers' Loan & Trust Co., who will issue certificates for the same. It is these certificates which will form the basis of trading on the Exchange. When the purchaser requires a delivery of the iron represented by a certificate he takes his certificate to the Farmers' Loan & Trust Co., who stamps it 'for cancellation' and signs a delivery order which the warrant company issues. One great advantage to the trade will be that the trust company will report to the committee on pig iron each day the places where the iron represented by the warrants that are out are stored, and the purchaser can take his certificate and have it exchanged for a delivery order in any of these places he may desire by adjusting the difference to make his iron equal the value of No. 2 foundry pig iron stored in a New York warehouse."

The Shenango steel mill of the Carnegie Steel Co., New Castle, Pa., was closed this week for an indefinite period. This is the off season in the tin plate trade and as the Greer mill at that place is shut down, and as a large portion of the steel plant's output goes to this mill, the converters have been shut down to prevent an accumulation of bars.

Marquis F. Dickinson, of Brookline, Mass., and Samuel K. Hamilton, of Wakefield, Mass., have been appointed receivers for the Jefferson Mfg. Co., Lexington, Mass. The American Tube Works, of Somerville, Mass., applied for the receivership.

The stack of the Struthers Furnace Co. at Struthers, O., was blown in Oct. 24 after being idle for three months and ten days.

PERSONAL.

H. F. Vogel, vice president and general manager of the St. Louis Car Co., started last week on an extended business trip to Europe.

The Charles Creighton Foundry Co., 155th street and Eighth avenue, New York City, having sold a large share of its stock to Mr. Charles H. Thomas, at present superintendent of the Hay Foundry & Iron Works, Newark, N. J., has engaged Mr. Thomas as manager, and he assumed entire management of the concern Oct. 24. Mr. Thomas is president of the Associated Foundry Foremen.

Harry Soady, of Iron Mountain, Mich., who has been employed for the past twelve years at the office of Chapin mine, has accepted a position as traveling representative for the Rand Drill Co. on the Lake Superior iron ranges and in the copper country.

Edmund Wilson Tetlow, who for the past five years has represented the Home Rubber Co., of Trenton, N. J., has been engaged to look after the interests of James Bonar & Co., Inc., in the Pittsburg district, and will have his office at 516 Frick building, Pittsburg.

It is reported that E. A. S. Clark, general manager of the International Harvester Co., was proposed at a recent meeting of the directors of the Lackawanna Steel Co. for election to the position of president made vacant by the resignation of Walter Scranton more than a year ago. It is understood that the proposition was received with favor, but no official announcement has been made.

T. J. Joyce, of Domhoff & Joyce, Cincinnati, has returned from a European trip of several months' duration. Mr. Joyce is much improved in health.

James Kilduff has been elected president of the Carbon Steel Co., Pittsburg, succeeding C. M. Raymond; J. W. Anderson has been elected vice president, while Frank Holland was continued as secretary.

Superintendent Wales, of the electrical department of the Homestead Steel Works of the Carnegie Steel Co., has announced the appointments of Charles Prandfoot as chief electrician for the Homestead Steel Works, Charles Menk for the Carrie blast furnaces and A. G. Cox for the Howard Axle Works.

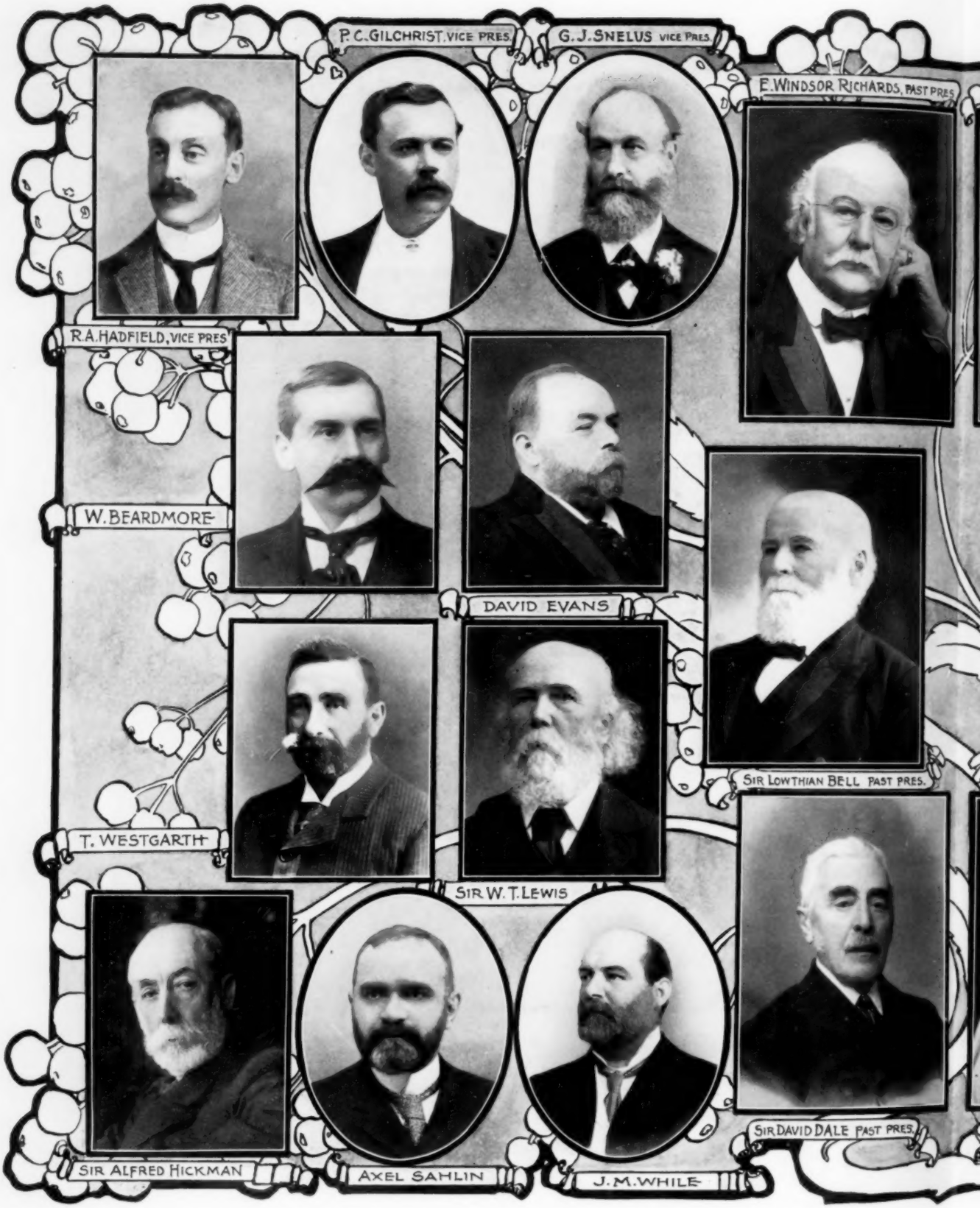
Clement F. Street has been appointed commercial engineer of the Westinghouse Electric & Mfg. Co. to handle work in connection with steam railroads. Mr. Street is an engineer of high rank and is well qualified to take charge of this important branch of the Westinghouse work. He has had a wide experience in the railroad field gained through connection with many important interests.

The Lake Shore & Michigan Southern railway has recently installed in its shops at Elkhart a complete oil house equipment for storing and handling oils. The equipment was furnished by S. F. Bowser & Co., of Fort Wayne, Ind., who have recently furnished similar equipment for the Pennsylvania Co. at Altoona, Pa., and for the Zeigler Coal Co., Zeigler, Ill.

The Dover Forge & Iron Co., Canal Dover, O., now has its plant in full operation manufacturing charcoal iron tin plate bar, sheet bar and billets. The company is also making hammered iron sheet bar, tin plate bar and billets. It has a capacity of 25 tons per day of common iron sheet bar. The results obtained in these lines have been very satisfactory.

The Timblin Engineering & Foundry Co., Creighton, Pa., has decided to move its plant from Creighton to some other location which has not been selected.

The National Drill Works, Cambridge City, Ind., is making rapid preparations to start with a large force Nov. 1. A small force is now at work.



REPRESENTATIVE MEMBERS AND OFFICERS

OFFICERS OF THE IRON AND STEEL INSTITUTE

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THE LEADERS IN THE IRON AND STEEL RACE.

The changes in the American iron trade since the first visit of the Iron and Steel Institute to this country in 1890 naturally come up for consideration in connection with the visit the Institute is now making. As is indicated at some length in other columns, they are many and significant. They bear chiefly upon the situation at home, but at the same time are of moment as affecting the position of the United States in what may be termed the tripartite struggle for supremacy in iron and steel in world markets, for Great Britain, Germany and the United States are now the only countries to be considered.

Fourteen years ago, the Mesabi range with its hundreds of millions of high grade ores was undiscovered. The American tin plate industry had no existence, and the use of steel in construction work to replace wood and stone had scarcely begun to expand. The United States Steel Corporation was not thought of. Add to what is expressed in these three sentences all that is embraced by the rapid evolution of "American practice" in iron and steel making, not omitting the stride from 62 to more than 80 millions in population, and we have summarized to a large extent the causes of the advance comprehended between 1890 and 1904. Nature has combined with the engineer, the manager, the legislator and the latter-day financier to produce the result.

Fourteen years ago the British and German visitors studied the American iron and steel industries with two questions in mind: 1. Whether the iron and steel works of the United States would be able to meet all domestic needs and make iron and steel imports practically unnecessary. 2. Whether the United States would ever become a competitor in iron and steel in markets apart from the Western Hemisphere. The first question was generally answered in the affirmative, the second in the negative. Sir Lowthian Bell, in his exhaustive commentary on the American iron industry as he found it in 1890, concluded that it was improbable that with pig iron costing $13 at Pittsburg and a freight of $2 to seaboard, there would be any competition with Great Britain from the older seats of the American iron industry, except in countries close to the United States.

The developments of the past 14 years in American iron and steel making have swept away Sir Lowthian's premise and with it has gone his conclusion. It is no longer $13 pig iron at Pittsburg with which such calculations have to do, but with a $13 steel cost and lower. And all theories and census statistics and paper costs give way before the hard fact that today the steel billet and finished product exports by the United States Steel Corporation are at the rate of more than 1,000,000 tons a year, or about one-eighth of its entire output, and a round tonnage of it going into the British Isles themselves.

Since 1890 Germany, then a trailing third in the international race, has forged into second place and has become the real competitor of the United States, gauged by ability to attain low cost on a large proportion of its output. Minette ores and a maximum saving on fuel bills through by-product recovery and large use of gas for power, have been large offsets to the richness of Lake Superior ores and Connellsville coal. In fact, those who have canvassed the relative positions of Great Britain, Germany and the United States, based on the cost of steel put into cars at works have found German works to which they were willing to award the palm.

But perhaps there has been too great a tendency to reduce the question of the future of the three leaders in the race for supremacy in iron and steel to one of assembling and manufacturing costs. Other factors of importance have too often been left out of the account. The United States will continue indefinitely to be the largest consumer of iron and steel, gross and per capita. That fact will always count tremendously in favor of the home manufacturer. It will be many years—if the point is ever reached—before he must look to foreign trade for any important fraction of his profits. The Government policy of raising revenue by the indirect method of a protective tariff will count heavily in his favor. The elimination of weak producers of iron and steel through the consolidation movement of recent years must be reckoned no small factor in the international problem. Freed from the drag of weak or bankrupt properties, the American iron trade was never surer of reasonable profits at home. The industry in Germany will have important benefits in this direction as the result of recent movements.

It will be interesting in connection with the considerations urged above, which of necessity can only be broadly general, to present the statistical story of the changes that have come since 1890 in the positions of the three nations as manufacturers of iron and steel. We give below the output of pig iron and steel ingots

in the United States, Germany and Great Britain in 1890, at the end of each of the five year periods following and in the year 1903. Tons of 2,240 pounds are used, except in the figures for Germany, which are in metric tons of 2,204 pounds, the difference being negligible so far as affecting the comparison.

PRODUCTION OF PIG IRON IN UNITED STATES, GERMANY AND GREAT BRITAIN.

	U. S. Gr. tons.	Per Cent.	Germany. Net tons.	Per Cent.	Gt. Britain Gr. tons.	Per Cent.
1890	9,202,703	42.3	4,658,450	21.4	7,904,214	36.3
1895	9,446,308	42	5,464,501	24.2	7,703,459	33.8
1900	13,789,242	44	8,520,541	27	8,959,691	29
1903	18,009,252	48.8	10,085,634	27.3	8,811,204	23.9

PRODUCTION OF STEEL INGOTS IN UNITED STATES, GERMANY AND GREAT BRITAIN.

	U. S. Gr. tons.	Per Cent.	Germany. Net tons.	Per Cent.	Gt. Britain Gr. tons.	Per Cent.
1890	4,277,071	42.3	2,161,821	21.3	3,679,043	36.4
1895	6,114,834	45.5	3,931,318	29.3	3,389,962	25.2
1900	10,188,329	46.6	6,645,869	30.4	5,001,054	23
1903	14,415,017	51	8,801,515	31	5,034,101	18

We make no comment upon the figures, beyond pointing out that the United States and Germany have made an almost uniform advance both in actual and proportionate outputs of pig iron and steel in the past 14 years, while Great Britain has steadily declined in percentage outputs of both; that while the United States last year doubled its pig iron production of 1890 and that of Germany more than doubled, that of Great Britain showed last year only 12 percent increase over 1890; that while the production of steel ingots in the United States in 1903 was 3½ times that of 1890 and Germany was more than four times that of 1890, the increase in Great Britain was only 40 percent.

Without pursuing the subject farther, it may not be amiss to say that if there be an "American peril" or a "German peril," from the standpoint of the British iron trade, its nature and the measures to be taken against it are not to be arrived at by a study of natural advantages in raw materials and of engineering and works economies alone. It is significant that in 14 years after Sir Lowthian Bell's volume appeared, with its conclusion that a protective tariff had really hampered the American iron trade, there should be a sturdy agitation in his own country in favor of measures of protection to the British iron trade against American and German aggression. Perhaps after all that is the most striking development of the 14 years in respect to the tripartite race for international supremacy in iron and steel.

National Metal Trades Association.

The National Metal Trades Association, with headquarters in the Union Trust building, Cincinnati, has issued a pamphlet giving testimonial letters from a number of prominent companies, telling in some detail how the association is of benefit to employers. These testimonials speak in terms of highest praise of the work that is being done. They come from the following companies: The Helman Machine Works, Evansville, Ind.; Curtis & Co., Mfg. Co.; Remington Machine Co., Wilmington, Del.; The Adams & Westlake Co., Chicago; Memphis Machine Works, Memphis, Tenn.; The Gardner Governor Co., Quincy, Ill.; The John Davis Co., Chicago, Ill.; The Canadian Locomotive Co., Kingston, Ont.; the Brown Cotton Gin Co., New London, Conn.; Charles F. Elmes Engineering Works, Chicago; William R. Perrin & Co., Chicago; Comptograph Co., Chicago; Latham Machinery Co., Chicago; Bates Machine Co., Joliet, Ill.; Blakeslee Mfg. Co., Du Quoin, Ill.; Lincoln Iron Works, Rutland, Vt.; E. B. Hayes Machine Co., Oshkosh, Wis.; The Kempsmith Mfg. Co., Milwaukee, Wis.; the Norwood Engineering Co., Florence, Mass., and the Kennedy Valve Mfg. Co., New York City.

Cars for the Panama Canal.

Bids were opened at the office of the Panama Canal Commission Oct. 20 for supplying dump cars, flat cars, cement vitrified pipes, valves and hydrants to be used in construction work on the canal and in the water and sewage system. The total amount of the bids will be about $2,500,000. The most important bids opened were those for 1,000 steel dump cars, to be delivered at Colon. They were as follows: Standard Steel Co., Pittsburg, $1,600 each; Goodwin Car Co., New York, $2,575 each; Roger Ballast Car Co., Chicago, $1,800 each; Western Wheeled Scraper Co., Aurora, Ill., $909 each; Pullman Car Co., Pullman, Ill., $1,350 each; Western Steel Foundry Co., Chicago, $1,706 each; American Car & Foundry Co., St. Louis, $1,300 or $2,000 each, for cars of different dimensions; Middletown Car Works, Middletown, Pa., $2,150 each for 100 cars only. For 500 flat cars the bids were as follows: South Atlantic Car Co. Waycross, Ga., $795 each; Standard Steel Car Co., Pittsburg, $925 each; Pressed Steel Car Co., Pittsburg, $820 each; American Car & Foundry Co., St. Louis, $1,075 each.

The Ohio Society of Mechanical, Electrical and Steam Engineers will hold its next meeting on Nov. 18 and 19 in Canton, O. A large attendance is assured. Among the papers which will be read are the following: "System for Daily Inventory of Plant Cost," James L. Butler, chief draughtsman, Stirling Boiler Co., Barberton, O.; "Liquid Fuel and Oil Burners," George G. Bennett, district examiner, Stationary Engineers, Cleveland, O.; "Heavy Duty Engine Service in a Modern Steel Plant," Arthur L. Strickland, assistant chief engineer, Bessemer plant, Republic Iron & Steel Co., Youngstown, O.; "Boilers and Furnaces," W. C. McCracken, chief engineer, Ohio State University, Columbus, O.; "Notes on Boiler Tests," J. E. Bell, mechanical engineer, Stirling Boiler Works, Barberton, O.; and "Gas Engines in Power Plants," (paper illustrated with lantern slides). William T. Magruder, professor of mechanical engineering, Ohio State University, Columbus, O.

At the annual meeting of the Manufacturers' Association of Pittsburg officers were elected as follows: W. H. McFadden, Mackintosh Hemphill & Co., president; H. C. Shaw, A. Garrison Foundry Co., vice president; Stewart Johnson, Pittsburg Steel Foundry, treasurer; councilors, W. C. Scott, Thomas Carlins Sons' Co., and Edward Kneeland, United Engineering & Foundry Co. George Mesta, president, and L. W. Frank, vice president, refused another term. George Cooper, secretary, resigned. The vacancy has not been filled.

The Lackawanna Tunnel Railroad Co. is capitalized at $300,000 and controlled by the D. L. & W. R. R. It is proposed to build and operate a railroad from Manhattan, south of West 23d street, through one or more tunnels under the Hudson River to Hoboken. The directors of the Lackawanna Tunnel Co. are W. M. Truesdale, E. E. Loomis, O. C. Post, Thomas E. Lee, George F. Wilson, A. D. Chambers, Fred. F. Chambers, William S. McGuire and Walter W. Ross.

The blast furnace of the Ohio Iron & Steel Co., Lowellville, O., will resume operations next Monday. This furnace has been idle for several months owing to the depressed condition of the iron market.

New York Meeting of the Iron and Steel Institute—Presentation of the Bessemer Medal.

NEW YORK, Oct. 25.—The formal opening of the second American meeting of the Iron and Steel Institute which took place at Sherry's, 44th street and Fifth avenue, last night, was worthy, both in circumstance and interest, of so marked an event in the history of the organization. Words of welcome were spoken by representative men in official place in municipal and engineering life, and Andrew Carnegie, from whom the suggestion of a second American meeting originally came, had bestowed upon him the badge of the highest honor in the gift of the Institute.

There has been a steady influx of Institute members to New York for the past ten days, in ones and twos and threes, but the main party, numbering about 125, came on the Celtic, landing on Sunday. They were received by members of the general American committee and the New York committee, the large majority of the party being quartered at the Hotel Astor, 44th street and Broadway. On the eighth floor of the hotel the secretary of the Institute and officers of the local and general committees had established headquarters, which became the starting point for the various trips about New York. Monday was given up to piloting the visitors to important engineering operations in and about New York. The new subway, which is to opened formally on Thursday, was naturally chief in interest, and a special train was put at the disposal of the visitors for an inspection of this splendid monument to the ambitions and the engineering skill of latter-day New York. The new East River bridge and the Brooklyn bridge were also visited, as well as the New York Navy Yard, where were seen the Battleships Kearsarge, Kentucky, Illinois, Texas and Connecticut and the Cruisers Dolphin and Chattanooga. The New York & Jersey Railroad Co. gave facilities for the inspection of the Hudson tunnel works, and a visit was paid to the New Jersey shaft of the Pennsylvania tunnel. The machinery at the Waterside Station of the New York Edison Co., 38th street and East River, was seen late in the afternoon, running under full load, the largest types of reciprocating engines and the steam turbine being shown in operation side by side.

Opening Session and Reception.

The Monday evening reception at Sherry's was a brilliant and memorable affair, attended by about 400 ladies and gentlemen quite evenly divided between British and American circles. Eclat was given to the occasion by the presentation of the Bessemer gold medal to the first American president of the Institute who is so much better known in the role of donor than recipient. Charles Kirchhoff, past president of the American Institute of Mining Engineers, chairman of the American executive committee, gracefully introduced the speakers, presenting first Charles V. Fornes, president of the New York board of aldermen, who made the address of welcome as representative of Mayor McClellan.

Address by John Fritz.

When Mr. Kirchhoff introduced "your and our Uncle John Fritz," who was to welcome the guests as president of the American committee, there was a warm and demonstrative expression of the regard of the assembly for the "grand old man" of American steel engineering, one of the five Americans to whom the Bessemer medal had been presented. Mr. Fritz said:

"Everywhere in this broad land where is an engineer you will find the hand of fellowship, and in its strong grasp feel the friendship that has grown out of our similar pursuits. The hard and perplexing toil has welded us into one great family, striving ever for the advancement of that greater family, the whole of mankind. Where has there been a greater liberator than the engineer? With every labor-saving device shackles have been struck from the hands of toiling humanity. The engineer has conquered time and space, and the full fruition of his victory is shared by all. How incomparably small seems the winning of a few paltry acres that are held for the chosen few by a constant vigilance and the force of arms. The engineer, in placing the forces of nature under man's control, has quickened civilization and commerce, furnished means for supplying the dearth of one nation from the fullness of the other, converted wilds of nature into fertile fields and made happy homes for millions.

"It does me honor, gentlemen, to welcome to our shores the Iron and Steel Institute, a society whose banner from its first raising has always stood in the front rank of progress, and has guided the way to heights the boldest had scarce dared hope to climb—a society of unselfish interests, whose membership comprises the ablest engineers and scientists, chosen without respect to nationality from all parts of the world; a membership whose sole object is the advancement of the most important of all human industrial institutions, the manufacture of iron and steel.

"To the able and farsighted men, who founded this Institute, belongs the gratitude of the civilized nations of the world, their sole object being the common good—their only reward being the satisfaction of an unselfish devotion in the science of metallurgy. And I cannot but think that every true man will respect those who worked so assiduously for the improvement of an article of such prime necessity to the civilized world.

"Let me ask, is there a higher world's calling, a more noble profession, or one that mankind is more deeply indebted to, than the metallurgy of iron and steel? Yet how few people know or even think of the debt they owe to workers in this invaluable field of science. Few have had the occasion to understand or appreciate the exacting labor of years, with the many tribulations and distressing accidents that occurred in the introduction and the advancement of processes of steel making, but only view it in its fully consummated form of today. Yet, with all its difficulties, and there were many, it is the most important branch of manufacture in the domain of human activity, requiring courage, endurance, and a varied talent—attributes which make the engineer of the highest ability.

"It was by combining our efforts that we have won the progress of the world. Let us further combine our efforts that we may stamp our impress upon the nations, and striving always for purer and higher things do still more for mankind than we have done for metals. It is by unity of purpose and of energy that all great ends are achieved. Let us then draw closer in our relations and intercourse, aiming to make 'the engineers' one large society, with a single aim and a thousand pursuits.

"We have already taken steps towards this most desirable end, and through the munificence of your worthy president we shall soon be gathered under one roof. This union will bear its fruits and we shall, in the years to come, find its weight in the scales of national affairs. But it is still further for you and me to go, joining hands across the seas, and throwing our united weights into the world's greatest balance for its own greater good.

"As I stand here tonight before you, I cast the eye of memory back through more than sixty years of unceasing

toil and activity in the iron and steel industry, which at times wakens anxious questioning as to whether we have gone too fast in this fierce race of manufacture. It is to the efforts of this society that we owe much; for while commercialism struggles for larger output, you, gentlemen, have always stood with steadfast eye watching the quality and always striving for higher heights. It is you who have always recognized the awful importance of the very highest quality in a material so universally used that we may almost say the life of the world today hangs on a bar of steel.

"Gentlemen of the Iron and Steel Institute, I avail myself of this opportunity to thank you from the bottom of my heart for the honor you have conferred upon me—an honor much beyond my desert. I have not the command of language to express to you the gratitude I owe for the universal kindness I have ever received from the members of the Iron and Steel Institute, and I sincerely wish for your all the greatest good that can possibly come to you."

Welcome by James Gayley.

Another speaker to receive an enthusiastic greeting from the audience was James Gayley, first vice president of the United States Steel Corporation and president of the American Institute of Mining Engineers. Mr. Gayley's paper on "Dry Air Blast for Blast Furnaces" is already spoken of in an anticipatory way as the feature of this meeting, from the standpoint of technical interest. In welcoming the visitors he said in part:

"We recall with much pleasure your visit of fourteen years ago. On that occasion your president was chief of hosts; today he becomes chief of guests. In choosing him, an American citizen, to preside over your institute, you have not only honored one who has contributed so much to the metallurgy and development of iron and steel, but who is recognized all over the world as perhaps one of the greatest contributors, and who has made magnificent with his every touch that industry. But we interpret this choice to have deeper significance in that it recognizes that we as nations are more closely akin.

"Your Institute represents technical talent and progress in metallurgy, in an age which can be most properly designated as the age of steel, and your achievements in that realm have contributed most generously and liberally to that age. When we consider the progress that we have made we look back and recognize that much of this has been the magnificent working out of ideas, which, although in many cases brought to perfection by us, nevertheless originated with you, and we believe that the achievements of one are also helpful to the other. In every branch of our industry we acknowledge the indebtedness we owe to the engineers and metallurgists of Great Britain. At a time when we began our industrial development they were past masters in the useful arts, and we appropriated everything that we considered of value and adapted to our needs. In return we have given you everything that it was possible to give, namely, the record of our practice in working out to perfection these processes in a country whose energies were devoted to industrial development and in looking back over a period of 30 years we realize that in appropriating your experience we have built upon a foundation sure and substantial.

"In your proceedings you have given with wonderful generosity the records of your best practice and experience. Those records have not only enriched the literature of manufacturing, but have contributed vastly to the progress of the world; and we, in turn, through our Institute, have endeavored to present in the same liberal manner the records of our best practice to you.

"In visiting our works you will no doubt find much that is new and valuable, for we have made great progress since your last visit. Your president at that time referred to the fact that for the first time in our history we had outstripped Great Britain in the output of pig iron. Since then we have doubled that output, and in every branch of manufacture we have made a progress such as was not contemplated at that time. And this represents not only the measure of our progress, but also, and fittingly, the measure of our welcome to you.

"I have said that we have appropriated everything of yours that we considered of value. We invite you on this visit, in the same neighborly spirit, to appropriate everything that you find of value among us. The greatest advantage to be gained by all is in the free exchange of experiences obtained under different conditions, and in localities far removed from each other, for an interchange of ideas among people who have devoted their lives to a great industry becomes of universal value. Notwithstanding our own great progress we are proud to greet you as first citizens of the commonwealth of industry. We wish, and it is our dearest wish, that on the occasion of this visit we shall find that the friendships that were formed on the first visit have not only continued, but that new and lasting ones may be formed."

President Carnegie's Response.

Mr. Carnegie's reply to the addresses of welcome was characteristic for its evident interpolations in the things he had planned to say. At one point, turning to Mr. Gayley, he said: "I believe we shall need to make new discoveries of iron ore if we expect to be able to supply the world's demand for steel 50 years hence and still sell it substantially as cheaply as we do today." Mr. Carnegie said:

"Mr. Deputy Mayor and Gentlemen: On behalf of the Iron and Steel Institute, I beg to return grateful thanks for the exceedingly cordial invitation which you extend to us. Its warmth does not surprise us, for the Institute is no stranger to American hospitality. Fourteen years ago this very month we were your guests for the first time. Many then present are again your guests today. Among them I shall be pardoned for mentioning our distinguished past-presidents, Sir James Kitson, Bart., Messrs, Martin, Richards and Whitwell. The former then occupied the position of president, and I am sure you are delighted to see him again, for Sir James has become one of the important 'connecting links' which serve to bind closer together the two branches of our English-speaking race. He gives strong expression to this international feature in the last paragraph of his introduction to the volume containing a full and most valuable record of that ever memorable visit. It closes with these words: 'The friendships formed and the international courtesies bestowed are such as will confer everlasting pleasure and national benefit as long as their record endures.' Let us indulge the hope that our present visit may prove equally fruitful in drawing us all closer together.

"Man in his time plays many parts. From the same introduction I read that it was my privilege to occupy your present position and give the address of welcome at the first meeting. Today as president it has fallen to me to receive your address. Listening to your welcome, it occurred to me that, when as president I shall write my introduction to the forthcoming record, Sir James has already written exactly what I shall have to say. He notes that 'Mr. Andrew Carnegie, on behalf of the American iron and steel trades, gave the address of welcome at our first meeting, which was held on the 1st of October in Chickering Hall, New York. His eloquent address was most cordial, nay, even affectionate, in its warmth of expression. He promised that every mine, every manufactory, and every workshop would be absolutely open for our inspection, and further that any information asked would be cheerfully and frankly supplied. I repeat this in order that I may acknowledge (which I do in all sincerity) how fully and completely this undertaking was fulfilled, and I would express, on behalf of the institute, our grateful thanks for the information so generously given.'

"Gentlemen, you again present to us 'the open door' and we thank you. Upon our last visit the Institute was amazed at your extraordinary development, but they find today that rapid as that had been it has proceeded at even quicker pace since then. The figures are positively staggering. Your product of pig iron the year we visited you, 1890, was 9,200,000 tons; in 1903 it was over 18,000,000 tons. Thus, in thirteen years, it had doubled. In Bessemer steel production much more than doubled, and in open-hearth steel the increase is more than eleven-fold—from half a million tons in 1890 to nearly six millions in 1903. Your export trade in manufactures has increased nearly three-fold. In the decade 1890 to 1900 you added 13,500,000 to your population, and the national wealth increased from sixty-five to ninety-four thousand million of dollars. No wonder we come to see for ourselves and to study such portentous growth.

"There is one source of intense satisfaction open to our British members in doing so, for they cannot fail to remember that while to you is to be credited the development of the iron and steel industry here, it is to their older land that you are indebted for the inventions which have rendered such wonderful development possible. To Cort and Nelson, Thomas and Gilchrist, Bessemer and Siemens, you owe your success. The two latter our German and French members may respectively claim as countrymen, so that we have the three Teutonic branches and France here allied, as contributing partners to the achievement. The Institute congratulates the republic upon this surprising increase, which we note with satisfaction. Your growth has not lessened the output of any other country. The demands of the world have increased quite as rapidly as all the iron and steel making nations have been able to supply these, and, looking to the future, the question is not how various lands are to find a market for increased iron and steel production, but rather how the imperative demands of the ever-increasing population and for new developments of the world are to be met at reasonable prices. The needed supply of good ironstone is not by any means yet assured; we are compelled to base our hopes of increased supply of cheap steel on further discoveries.

"This Institute, Mr. Deputy Mayor, is cosmopolitan to an extent, I am inclined to believe, unprecedented. We have members from no less than nineteen of the most important countries of the world. Among these, we can safely say without immodesty, are most of the foremost scientific and business men engaged in iron and steel. This Institute has no narrow or selfish traits. The inventions and discoveries made in all these lands are promptly and fully explained at our meetings. The papers read at the last meeting illustrate this noble policy of publicity and mutual co-operation. Two leading manufacturers of armor plate described their latest processes and discussed their merits. We are all very proud of this feature. Some day the statesmen of various powers now viewing each other with unfounded suspicion may take a lesson from the world-wide Iron and Steel Institute. Were the representatives of one-fourth, or even fewer, of the countries which furnish our members to meet, as we do, men of of different color, race, nation, creed and politics, and cooperate in one common aim as we do in friendly rivalry, without heartburnings at what another gets, and applauding every success achieved, we should soon see a better and happier world. Meanwhile let us continue to set before the world an example of friendly co-operation and mutual goodfellowship which it might well follow.

"Again we thank you, Mr. Deputy Mayor and gentlemen of the Committee, for the hearty welcome extended, assuring you that all your kindnesses and unbounded hospitality is very deeply appreciated, indeed."

Presentation of the Bessemer Medal.

Sir James Kitson was cordially applauded when he rose, with the Bessemer gold medal in hand, to make the address of presentation to Mr. Carnegie. He said in substance:

"It has been a tradition with our institution, on visiting foreign countries, to confer the gold medal of the institution on a distinguished metallurgist, should a distinguished metallurgist exist in that country. And I may mention that we conferred the gold medal of the institution in past years upon Mr. Peter Cooper, upon the Hon. Abram S. Hewitt, upon Mr. John Fritz, who is now with us, upon Prof. Howe; and now again, ladies and gentlemen, there has been no want of distinguished metallurgists in your great country, in fact, it has been rather an embarrassment to select among so many distinguished men one upon whom we should confer this honor.

"I remember hearing that lookers-on see the best of the game; and probably we British metallurgists who have not been impeded or thwarted or jostled in the race to the goal can view with a calmer judgment the merits of Mr. Carnegie and the benefits which he has conferred upon the great iron and steel industry which we represent. If I were a Scotchman I might be conceited, but I am not a Scotchman, and therefore I do not venture to take away from the United States the honor of a great American by claiming him for my own, because I recognize that the germ so pregnant with celestial fire was reared in the American atmosphere, amongst American institutions, and what is still more it enjoyed American opportunities.

"You had here the great sources of power in nature stored up in prodigal abundance. It wanted the master mind to develop its resources and to use them for the benefit and advantage of the human race. You had great scientific men, great chemists and the rest—the great mechanics—but the great mechanic does not develop the iron and steel mines of the world alone. The great chemist points out to you what you should do and what you should avoid, but the great chemist does not develop those resources until he is combined with the energy and knowledge of the great man of business.

"You have had in Mr. Carnegie the judgment to foresee the great developments of your country, the sagacity to obtain control of the great resources of coal and iron with which you are so prodigally endowed; but you have had still more sagacity to choose the instruments and to use those instruments to give them the opportunity which their genius affords, so that those opportunities could be developed.

"I remember being with Mr. Carnegie in his Pittsburg works 14 years ago, and some complicated machinery which had just been installed was being shown us. I ventured rather timidly to ask Mr. Carnegie whether he understood the details of that machinery. He said, 'No, frankly, I don't understand the details of much of my machinery, but what I do claim to understand is the human machine.' And I think he has understood the human machine. He has gathered around him a magnificent staff, and he has encouraged that staff by generous remuneration, by wide opportunities to put forth the utmost of their powers, and to give the magnificent results which have astonished us and which have astonished the whole world.

"But it is not for this alone that we Britishers desire to confer this honor upon Mr. Andrew Carnegie. He has acknowledged in his address to you how much he has been indebted to the Old World for its inventions in iron and steel. He was very early searching with his keen insight and judgment for every improvement and every invention that was likely to develop the resources which he possessed.

"One of his earliest acquirements was the Dodds' patent for case hardening rails, and I happened to know that he made a very generous arrangement with Mr. Dodds. Following the Dodds agreement he made his arrangements with Bessemer, who has conferred amongst the greatest benefits that have been conferred even upon the United States. I remember, at our last meeting, the Hon. Abram S. Hewitt said: 'The results of the Bessemer invention have enabled

the United States to pay off the whole of its debt.' And I believe he was not speaking extravagantly, because, without the Bessemer invention you would not have been able to develop your railroads, you would not have been able to connect your vast territories together in this bond of union, unless you had been able to turn out with the rapidity that the great works of the United States have turned out, the enormous masses of Bessemer rails which have covered the earth.

"The Siemens gas furnace was also drawn from the old country; and following that Mr. Carnegie made a very prompt and a very generous arrangement with Mr. Thomas. For reasons of your own, very natural reasons I believe, the Thomas process has not been used here to the extent that it has been used in Germany, owing to the nature of your minerals. But nevertheless that agreement was made.

"For all this, Mr. Carnegie, and for all your generous appreciation of the mechanical arrangements and the mechanical details which have been properly remunerated when they have been used—for all these things and for all this acknowledgment which you have so generously given, we desire to confer upon you the greatest honor which we can confer, that is the Bessemer gold medal for services to the iron and steel trade. In presenting the medal I wish to say that when the great works which you have built up are changed, and are directed by new men, on newer methods, your name will ever be remembered in my native land as one who used his vast potentialities to promote literature and learning, and who showed by his actions that he loved his fellowman."

Mr. Carnegie responded in happy vein, referring at the outset to the various formal addresses made to him by mayors in presenting the freedom of cities, in which the speaker said rather what his position demanded than what he individually thought. Such words might not turn his head, though there was danger of it in such an address as Sir James Kitson had made.

"I am very glad, Sir James, that you discriminated. What I told you at Pittsburg was true. I do not understand mechanical and metallurgical details. I have no claim to knowledge of the various processes which result in the making of successful steel. Therefore when presented with a testimonial by the Stevens Institute I disclaimed as I do now any merit, and I said that I thought the fitting epitaph for me was, 'Here lies a man who knew how to get around him men cleverer than himself.' I might have some difficulty in proving it to you satisfactorily, but Mr. Gayley was one of the boys, and there are others just like him.

"There are three classes of men in the world. There are men who go through this world doing great work, and who do not receive the recognition which they deserve. There is another class of men of whom you might say, 'Well, yes, you have done good work and you have been appreciated—you have been rated according to your services.' There is a third class who really do feel and know that they get ten times more recognition than they are really entitled to. I think after receiving the Bessemer gold medal you will have no difficulty in distinguishing to what class the president of the Iron and Steel Institute belongs."

"But, Sir James, there is a serious point of view, when a man receives such tributes from his fellowmen. I do not deny that they are of great service to me. I do not hesitate to say that I believe such tokens do me great good and make me a better man. They do not exalt but they do humble one; because every one of those that I am surrounded with tells me that my dear fellowmen do have an appreciation of me, do have this kindly feeling for me, and do picture me in imagination as one worthy of esteem.

"I think that man must be of a mean, low character, who knowing that he is taken at higher than his value by his fellow citizens, if there is not stirred within him the determination that he will become in some degree more like the ideal that they formed of him. Therefore, Sir James, I welcome all such tributes, and I assure you that better than titles, better than rank, better than wealth, these are the patents of true nobility which I shall hand down to those who come after me with the message, that they humbled me at the time, but they have proved my supporters and my good angels all through my life. And this medal I hope to hold and pass to my descendants, as I receive it from you, pure gold, untarnished in my keeping."

Mr. Carnegie's was the last speech of the evening. Following it the assembly stood while the orchestra played "God Save the King" and "Star Spangled Banner." Then came dancing and the social mingling of guests and hosts.

Among those present, representing the engineers and the iron and steel manufacturers of the East, were the following: Walter Wood, Leonard Peckitt, J. S. Kennedy, F. H. Daniels, T. C. Martin, F. N. Hoffstot, Henry G. Atha, Peter Cooper Hewitt, Dr. David T. Day, H. H. Campbell, W. E. Corey, C. A. Moore, Geo. G. McMurtry, A. Fowler, E. G. Spilsbury. E. W. Parker, W. S. Pilling, E. C. Cook, Frank C. Roberts, T. I. Crane, John Birkinbine, Siegfried Pels, W. B. Dickson, Dr. T. M. Drown, Henry R. Towne, Prof. Henry M. Howe, Albert Ladd Colby, E. A. Uehling, C. H. Morgan, Chas. W. Hunt, F. H. Clergue, A. Sauveur, Geo. W. Maynard, Dr. R. W. Raymond, B. F. Fackenthal, Joseph Struthers, Phillips Isham.

Tuesday.

The day was given up to an excursion up the Hudson to West Point. The steamer Monmouth left the 23d street pier at 10:30 with nearly 700 on board, the clear sky and bright sunshine contributing to a day of rare enjoyment. The evening of Tuesday was left open for various private social functions.

Wednesday's Session.

(Special Telegram.)

NEW YORK, Oct. 26.—The sessions of the institute for reading and discussion of papers opened in the ball room of the Hotel Astor at 10 Wednesday morning. President Carnegie's first announcement was that of the election of R. A. Hadfield, of Sheffield, as president of the institute for the coming year. In the same connection he read an invitation on behalf of Mr. Hadfield and others for holding of institute meeting of 1905 at Sheffield. James Gayley was then introduced and presented a running synopsis of his paper on "The Application of Dry Air Blast to the Manufacture of Iron." It is given elsewhere in this issue in full and presents in detail the results of experiments carried on for the past year at Isabella furnaces in the refrigeration of air, with resulting saving of 20 percent in fuel consumption and increase of 25 percent in output. Mr. Gayley's paper has been referred to in the past day or two by the few who knew in a general way what it would contain, as the most important presented before the institute in years, and as ranking in revolutionary character with various discoveries presented to the institute in connection with the production of open-hearth steel. In the discussion following Mr. Gayley's reading, E. Windsor Richards referred to a paper read in Yorkshire in 1846 by Mr. Dawson, pointing out the difference in the amount of moisture entering a blast furnace in summer and winter months, showing that in summer the furnace does not drive as well or make as good iron. Mr. Richards thought Mr. Gayley was on the right road to effect an enormous improvement in this direction. He hoped the apparatus would not be very expensive and hoped Mr. Gayley would say what the saving was, since if cost of making pig iron could be lessened, it would be a great advantage to the British iron trade. Others who had experimented in this line, the speaker said, had failed, owing to the enormous amount of air that had to be dried. Mr. R. W. Raymond, secretary of the American Institute of Mining Engineers, said, "I am not afraid to say that Mr. Gayley has contributed to your proceedings this day one of the few great

classics of our art." This tribute was greeted with emphatic applause. E. P. Martin said that the paper bore out what had been passing in his mind for 10 to 15 years regarding the drying of air entering the blast furnace. An important requisite was that the desiccation be regular and continuous. And regularity as to the quantity of moisture in the air blown into the furnace would be found, as investigations went on, to be a prime factor in the problem. John Fritz, following Mr. Martin, said, "One of the most important things I know of in connection with the blast furnace is this question of varying moisture in the air. We have always known it but have never had the courage or the money to do what Mr. Gayley has done. We must acknowledge our indebtedness to the corporation with which he is connected, that furnished the money to carry these experiments to a successful outcome." Mr. Lamberton, of Coatbridge, said the paper was another revelation of possibilities of American practice. "We come over here," he added, "and get our eyes opened on every side." He regarded what had been presented as a new and very important development in blast furnace operation, for which great credit was due the author.

E. H. Saniter, referring to Mr. Gayley's mention of the possibilities of dry blast in steel working, said that if the subject is to be tackled from the open hearth point of view it would be found that the gas producer was a greater sinner than the atmosphere, but here, he thought, as in the blast furnace, uniformity of moisture content was the great consideration and the modern producer had made a considerable step in the direction of such uniformity.

Axel Sahlin, E. S. Cook and C. H. Morgan also participated in the discussion and Mr. Gayley concluded it by answering some of the questions that had been asked. He said that the old intervals of changing stoves had not been deviated from in connection with the new process. In respect to the application of dry blast to Bessemer practice, he said much was yet to be found out. His reference in this connection was to Bessemer pig iron containing one to one and a quarter percent silicon. As to the saving in cost, he had given the increase in output and the saving in fuel. From that the members could, no doubt, figure out the saving for themselves.

Another important paper of the morning session was that of H. H. Campbell, of Steelton, Pa., on "The Influence of Carbon, Phosphorus, Manganese and Sulphur on the Tensile Strength of Open-Hearth Steel." It was discussed by Dr. C. B. Dudley, James Mathews and Capt. R. W. Hunt.

Prizes Awarded at St. Louis.

The Allis-Chalmers Co., Milwaukee, and its electrical department, the Bullock Electric Co., Cincinnati, won the grand prizes in steam, electrical and mining engineering at the St. Louis Exposition. The electrical prize covered all the Bullock alternating and direct current generators and motors and rotary converters. A gold medal was also awarded for Bullock multiple voltage system for controlling motors.

The S. Obermayer Co., of Cincinnati, O., manufacturer of foundry facings and foundry supplies, has been awarded the highest award and gold medal at the St. Louis Exposition on plumbago, foundry facings and foundry supplies of all kinds.

The Roessler & Hasslacher Chemical Co., New York, has been awarded a grand prize.

Another 500-ft. steamer has been added to the list of vessels of that class to be built this winter and to come out at the opening of navigation next spring. The Craig Ship Building Co. last Saturday closed a contract with Cleveland parties for a freighter that will cost $330,000 and will have a capacity of 8,600 tons. The order placed Saturday makes 18 freight steamers for which lake builders have placed contracts. The new boats will have a carrying capacity of about 165,000 tons per trip.

The Labor Situation.

A CAMPAIGN OF EXTENSIONS.

Commissioner Eagan, of the N. M. T. A., has just returned from an eastern trip in the interests of the association. He had occasion to address a number of manufacturers in the metal working lines and his argument to the effect that all manufacturers in this line should join the association was along the line that it is the duty of every manufacturer who has to do with members of the metal trades unions to contribute to the cost of the every day fight against further encroachments and aggressions of the unions; which fight, every manufacturer who has followed the developments of unionism concedes must be made. It is obvious that this opposition must come from the manufacturers who are directly and vitally interested in order to prevent these organizations from developing the strength that characterizes the union of workers in the building trades, which strength has developed entirely because of lack of opposition. It is conceded that unless opposed these unions will extend their field of aggression to cover the entire country and will put upon manufacturers such conditions and limitations as will result in their inability to maintain the industrial supremacy which now belongs to this country. It has been shown that the International Association of Machinists knows no method of work except that of continual strife, that it will conduct just as many fights in just as many localities and for just as long a time as the condition of the treasury will permit. It is a far better proposition for manufacturers to contribute to the cost of resisting this fighting organization in a locality remote from his location when it is absolutely certain that such success will signalize the beginning of hostilities in other and untouched fields. Every union with which the association has to deal is national in its scope. The workmen all over the country are prepared to contribute towards the expense of a fight in any locality. The cost of such fight is borne by the national treasury and if it were not so, there would be no effective work. It is apparent to every one that a single local union, unaided by other unions or an outside organization, could never succeed in putting upon manufacturers conditions that are inequitable or unjust. It is the centralized power of these unions that makes them effective and the same kind of organization must oppose them.

The National Metal Trades Association is prepared in time of stress to render most valuable aid. The history of the recent fight in Chicago demonstrates this. The proposition as a general one should appeal to manufacturers most strongly. The association is carrying on a work that is conceded as necessary to be done and obviously must be done in the interests of and by manufacturers in the metal working line. It is not fair that 300 or 400 manufacturers should be permitted to carry the burden of expense of this necessary fight, the benefits of which must redound to every employer of metal workers in the country.

Mr. Eagan attended a dinner at Worcester, Mass., Oct. 11, and a dinner at Springfield, Mass., on Oct. 13, at which 50 manufacturers were present. E. H. Cutter, of the Knox Automobile Co., presided on this occasion and the speakers were H. H. Bowman, president of the Board of Trade, Commissioner Eagan and others. A smoker was given by the Manufacturers Association of Hartford Co., Hartford Ct., Oct. 17, at which A. W. Gilbert presided. Commissioner Eagan was the principal speaker. On Oct. 19 the Boston Metal Trades Association gave a dinner. Mr. Arnold, of the American Tool & Machine Co., presided and addresses were made by Commissioner Eagan, Mr. J. W. Gardner, of Quincy, and Mr. Sayward, secretary of the Master Builders' Association, of Boston.

This is an example of the preliminary work that is being done in a campaign of extension and there is a decided feeling

of interest in the National Metal Trades Association at all points. Mr. Eagan reports business conditions better.

THE MOLDERS' STRIKE IN CINCINNATI.

The latest development in the strike situation in this city was the meeting of the local organizations of the molders on Sunday, at which meeting a way was opened by which many of the striking molders could return to work. The local executive board was empowered to open up any of the struck shops they may see fit, either with or without the consent of the foundrymen. This will amount to lifting the union embargo against some of the foundries, so union men can go back to work in them without violating their pledges as members of the labor organization. One of the foundries has taken its former employes without any agreement and it is expected that others will take some of their men back in the near future. The National Foundrymen's Association is filling the shops with men right along and the action of the molders' union is practically an acknowledgment of defeat. There is little or no trouble now around the struck shops and the picketing is not at all offensive or menacing and is not carried on vigorously.

TWO MEN KILLED AT YOUNGSTOWN.

The strike of the iron workers employed at the Youngstown, O., mills of the Carnegie Steel Co. resulted in the death of two of the strikers on Saturday, Oct. 22. One of the employes of the company was roughly handled by a crowd of strikers and his collar bone broken. Drawing his revolver, he fired two shots, killing two of the men who it is alleged attacked him. President Shaffer, of the Amalgamated Association, was in New York last week in conference with President Corey, of the United States Steel Corporation, for the purpose of arranging a conference to settle the strike. At a meeting held in Youngstown this week President Shaffer announced that his trip had been fruitless and that no conference could be arranged.

METAL TRADES ASSOCIATION NOTES.

The St. Louis Metal Trades Association reports that with a single exception all the requisitions for mechanics were filled by their labor bureau.

The Curtis Mfg. Co., which has been operating on the open shop principle in all of its departments excepting the saw department, has determined to operate the latter on the same principle.

The annual meeting of the St. Louis Metal Trades Association will be held during the coming month. The executive board will fix the date of its next meeting.

The molders' strike in St. Louis has about subsided, and all the struck foundries are running along satisfactorily.

The annual meeting of the Manufacturers' Association of Pittsburg was held Tuesday, Oct. 25, at 2.30 at the office of the association.

The New York Metal Trades Association has engaged commodious rooms at 42 South street for the maintenance of a labor bureau. With the close affiliation existing in the chain of labor bureaus now in operation, this bureau is in a position to make its operations one of the valuable features of the association.

LABOR NOTES.

An unconditional surrender of the strikers at the shops of the W. A. Fletcher Co. marked the ending of the disastrous strike of the members of the Brotherhood of Boilermakers employed in New York shipyards, which went into effect May 4. About 8,000 men were out on strike at one time, but they have been gradually returning, those of the Fletcher Co. being the last to resume work.

The strike of the sheet metal workers in Philadelphia and other cities was settled Oct. 21 through an agreement with the employers by which strikes and lockouts are forever barred. The men have obtained an increase from 37½ to 40 cents an hour in wages and a guarantee that only union men will be employed, while the employers have gained the advantage of immunity from all labor troubles in the future.

Notice was posted in all the shops of the American Locomotive Co., Schenectady, N. Y., Oct. 22, to the effect that all men on piece work would no longer be needed.

As a result of a cut in wages, without a corresponding reduction in the working hours, the hammer men employed at the Latrobe Steel Works, Latrobe, Pa., have struck. The plant employes 600 men, and it is feared the strike may become general.

The Canadian Pacific railroad and its boiler makers have come to an agreement over wages. The men will have an increase of a cent and a half an hour.

The strike at Hanging Rock, O., which involved the 200 employes of the Hamilton furnace, has been declared off, leaving the company at liberty to hire as it pleases, unhampered in any way. The strike was inaugurated about five months ago.

The jury in the case of Philip Weinseimer, former president of the Building Trades Alliance at New York, returned a verdict of guilty of the charge of extortion. It was shown in the evidence that, although Weinseimer has an income of only $1,300 a year, he had deposits in various banks of New York aggregating more than $80,000, and was unable to explain how he had saved such a large amount of money.

New Railroad Equipment.

The following companies have ordered cars from the American Car & Foundry Co.: The Cincinnati, Hamilton & Dayton Railroad Co., 4,000 freight cars; the Toledo & Ohio Central Railroad Co., 200 box cars; the Swift Refrigerator Transportation Co., 100 refrigerator cars, making 700 cars ordered by this company since Sept. 23; the Atchison, Topeka & Santa Fe Railway Co., 35 freight cars; the Chicago, Burlington & Quincy Railroad Co., 10 passenger coaches. The Chicago, Burlington & Quincy Railroad Co. is considering the purchase of 1,000 box cars of 80,000 pounds capacity. The Swift Refrigerator Transportation Co. has ordered 200 double-deck stock cars of 60,000 pounds capacity.

The Chicago, Burlington & Quincy Railroad Co. is considering the purchase of 25 freight locomotives. The New York Central & Hudson River Railroad Co. is in the market for 25 locomotives. The Cincinnati, Hamilton & Dayton Railroad Co. has ordered 9 simple 10-wheel locomotives for Nov. 15, 1904, delivery.

At a meeting of the board of directors of the Crucible Steel Co. of America, held at Pittsburg this week, officers were elected as follows: Frank B. Smith, president and general manager; Reuben Miller, first vice president; Herbert DuPuy, second vice president; Charles E. Clapp, third vice president; Alexander Thomas, secretary; and Julius Bieler, treasurer. Executive committee: William G. Park, chairman; Frank B. Smith, J. D. Lyon, James H. Park, Reuben Miller, Herbert DuPuy and A. W. Mellon. J. D. Lyon succeeded W. P. Snyder as a member of this committee.

W. M. Brewer, president of the Colonial Foundry & Machinery Co., South Norwalk, Conn., has purchased an interest in the H. A. Tuttle Mfg. Co., Stamford, Conn., and the machinery has been moved to South Norwalk. Gasoline engines, reverse gears, tapping machines and some other specialties will be manufactured.

A court order has been issued requiring cause to be shown by Oct. 27 why the plant, machinery and other assets of the Henry McShane Mfg. Co., Baltimore, Md., should not be offered for sale at public auction by the receivers. The receivers have been offered $150,000 for the property.

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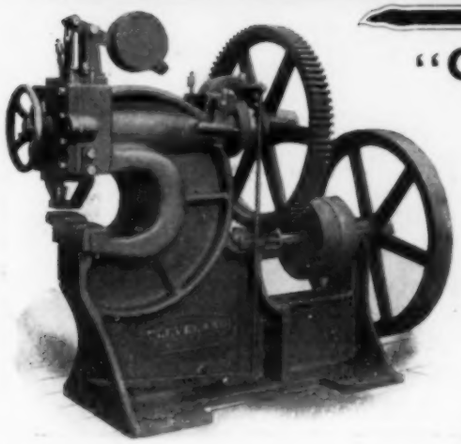

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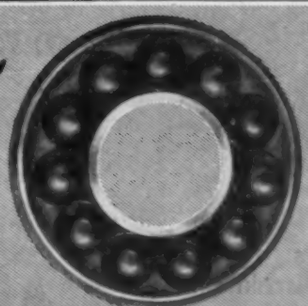

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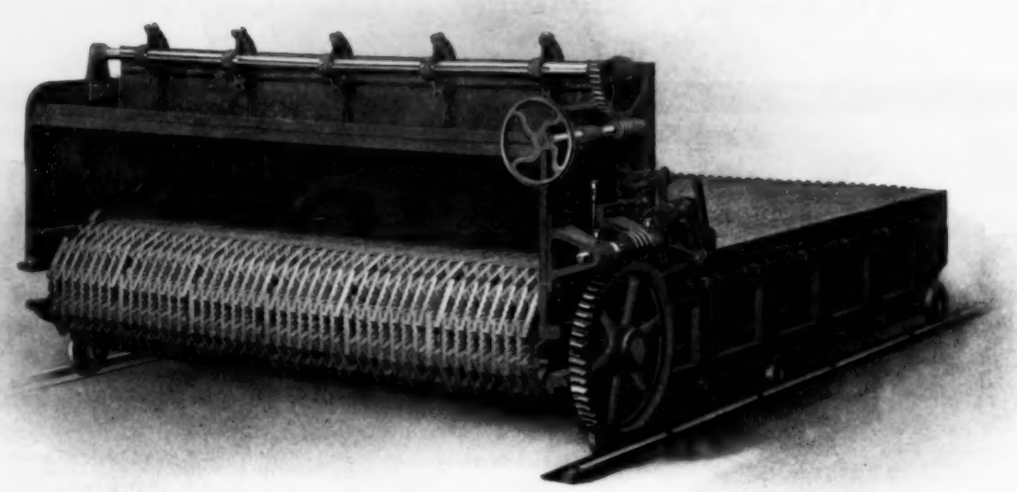

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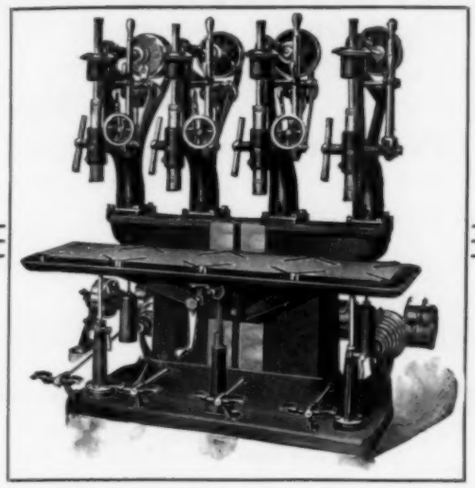

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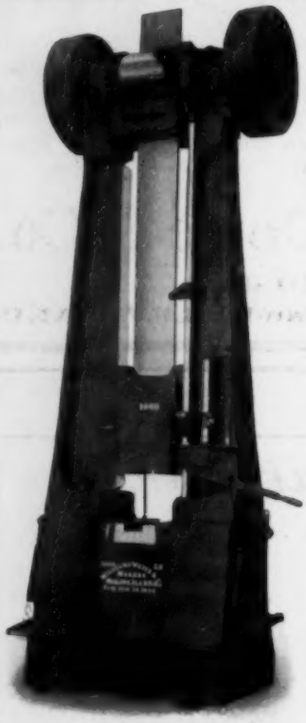

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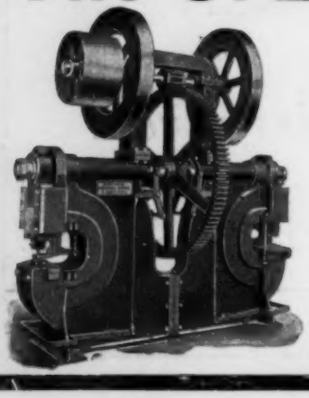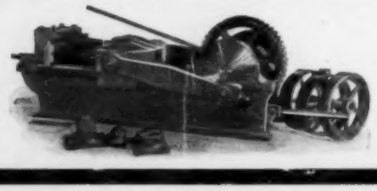
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